Self-Efficacy in Adults With and Without Learning Disabilities

by

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Abstract

Academic self-efficacy of post-secondary students with learning disabilities (LD) and of normally-achieving (NA) students was studied using ability and achievement tasks. Predicted and obtained scores were gathered on nine subtests of the Wechsler Adult Intelligence Scale-Revised (WAIS-R) and on all three subtests of the Wide Range Achievement Test-Revised (WRAT-R). Self-efficacy was measured by students' predictions of their relative performance on these subtests. Based upon Bandura's (1977) self-efficacy theory, I predicted that: (a) the NA group would tend to overestimate its performance whereas the group with LD would tend tc underestimate or have realistic expectations in areas where the latter group perceived failure, and (b) the group with LD, in its perceived nondeficit areas, would tend to respond in a similar manner to the NA group. Overestimation, underestimation, and realistic estimation were measured by the difference between predicted and obtained subtest scores.

Initial analyses compared the NA group and the total group with LD. Supplementary analyses were then performed using groups with LD that were high and low in severity as measured by three factor scores: Decoding, Reading Comprehension, and Arithmetic.

Significant interactions among Groups by Predicted/Observed scores by Tests were found on the WRAT-R and WAIS-R. As expected, in areas of perceived disability for the group with LD, the NA group tended to overestimate its ability relative to the group with LD, and on the WAIS-R performance subtests, estimations of the group with LD generally resembled those of the NA group. Implications are discussed for self-efficacy research, subtyping of groups with LD, and remediation in educational and counselling contexts.

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CHAPTER ONE - INTRODUCTION

I propose to investigate how post-secondary students with and without LD estimate their performance relative to their chronological age-mates on tests of ability and achievement. The theoretical framework for interpreting findings in this study is Bandura's (1977) construct of self-efficacy. Self-efficacy is measured by examining people's predicted and observed scores in specific tasks. My hypotheses are primarily based upon publications by Bandura on self-efficacy (e.g., Bandura, 1977, 1989a, 1989b; Bandura & Schunk, 1981; Evans, 1989) and also on an article by Taylor and Brown (1988). Bandura (a) develops the construct of self-efficacy, (b) describes how to measure the construct, and (c) discusses the importance of moderately optimistic levels of self-efficacy. Taylor and Brown further argue that optimistic beliefs are crucial to well-being. Optimistic self-efficacy refers to overestimation of ability when predicted scores are compared to observed scores (Bandura, 1989a).

Bandura's Construct of Self-Efficacy

Bandura (1977) wrote a seminal article in which he developed the concept of self-efficacy. According to him, self-efficacy plays a central role in motivation: "explanations of personal efficacy determine whether coping behavior will be initiated, how much effort will be expended, and how long it will be sustained in the face of obstacles and aversive experiences"(p. 191). He argues that self-efficacy is influenced by events and experiences which are processed through cognitive mechanisms. Bandura's theory was derived to explain behavioral change following treatment and consequent changes in the belief that one has the ability to perform successfully.

Self-efficacy refers to the belief that one can accomplish tasks successfully. Bandura and Schunk (1981) state that "self-efficacy is concerned with judgments about how well one can organize and execute courses of action required to deal with prospective situations containing many ambiguous, unpredictable, and often stressful elements" (p. 587). Self-efficacy is most strongly activated when goals are proximal (i.e., concrete and immediate). In well-defined situations, the likelihood of response will be based upon whether past similar events are interpreted as having been successful or failed. When situational demands are unclear, strong efficacy expectations are crucial for task initiation and persistence.

Strategies for Increasing Self-Efficacy

Self-efficacy is affected by four types of informative feedback: (a) performance accomplishment, (b) vicarious experience, (c) verbal persuasion, and (d) emotional arousal (Bandura, 1977). **Performance accomplishment** is most influential "because it is based on personal mastery experiences...successes raise mastery expectations; repeated failures lower them, particularly if the mishaps occur early in the course of events" (Bandura, 1977, p. 195). Various experiences affect perceived self-efficacy through attribution and contextual factors. When successes are attributed to ability independent of environmental support, self-efficacy is strengthened, and when successes are attributed to effort, it is weakened. Bandura suggests that **vicarious experience** (observing peers performing acts successfully) heightens self-efficacy if observers can identify with the actors, if outcomes are successful, and if there are no adverse response consequences. **Verbal persuasion** may also be effective, depending upon variables such as the persuader's credibility, authority, and corrective feedback. Finally, **emotional arousal** provides important cues about personal vulnerability leading to crucial cognitive appraisals of the arousal. Although avoidance strategies may reduce arousal, self-efficacy is unlikely to increase unless adaptive problem-solving skills are acquired. Self-efficacy is therefore shaped through performance, vicarious experience, persuasion, and emotional arousal (Bandura, 1977).

Operational Definition of Academic Self-Efficacy

Bandura (1977, 1989a, 1989b), Schunk (1996), and Pajares (1994), advocate a "microanalytic" approach in defining self-efficacy by obtaining expected performance in specific tasks. Bandura argues that "subjects must understand what kind of behaviors will be required and the circumstances in which they will be asked to perform them. In this type of microanalysis both efficacy expectations and corresponding behaviors are measured in terms of explicit types of performances rather than on the basis of global indices" (p. 204). They criticize the use of omnibus tests which give only general estimates of performance because judgment situations are abstracted from specific tasks and contexts.

Bandura (1989a) states that, as a group, so-called normals tend to overestimate performance, adding that "optimistic self-appraisals of capability that are not unduly disparate from what is possible can be advantageous, whereas veridical judgments can be self-limiting" (p. 1177). He adds that "in nonhazardous activities, optimistic self-appraisals are a benefit rather than a cognitive failing to be eradicated" (Bandura, 1989b, p. 732). After describing complex operations hidden in apparently simple subtraction problems, Bandura and Schunk (1981) observe that "it is not surprising that children sometimes overestimated their capabilities, especially on tasks that appeared deceptively simple" (pp. 595-596). Commitment and willingness to persist in challenging intellectual learning situations requires the optimism and resilience associated with perceived self-efficacy.

Efficacy, Self-Concept, and Self-Esteem in Judging Performance

Two concepts may be distinguished from self-efficacy: (a) self-concept and (b) self-esteem in judging performance. Self-efficacy involves estimating level of performance in specific tasks having certain ambiguous elements. Bandura (1986) defines self-concept as a global self image based on direct experience and on feedback from significant others. The requirement of judging the likelihood of success in specific tasks distinguishes self-efficacy from global representations of self-concept such as those proposed by Byrne and Shavelson (1986). The latter authors postulate a hierarchical model of the self based upon people's images of themselves. At the highest level of the three-tiered hierarchy is the general self-concept, at the next level are separate academic and non-academic self-concepts, and at the lowest level are even more differentiated self-concepts (e.g., within the academic self-concept are subareas of English, History, Mathematics, and Science). Studies of the self-concept typically use questionnaires measuring general self-perceptions rather than using "microanalytic" approaches (Bandura, 1977) to obtain estimates of performance on explicit tasks.

Self-esteem is an evaluation of worth based upon self-perceptions of personal and societal values (Bandura, 1986). Self-efficacy involves perceptions of ability to perform a task, whereas self-esteem involves perceptions of personal merit (Renick & Harter, 1989).

Self-Efficacy and Mental Health

Taylor and Brown (1988) argue that unrealistic optimism is related to healthy adjustment and that, typically, most people tend to evaluate their ability highly. They state that mental health theories usually assume that accurate contact with reality is crucial for mental health (see Hogarth, 1987); however, an emerging body of research shows that optimism plays a major role in effective motivation and that different groups' perceptions of ability vary (Bandura, 1986; Seligman, 1990; Seligman, 1993; Taylor & Brown, 1988). For example, people who are "low in self-esteem, moderately depressed, or both are more balanced in self-perceptions... the individual who experiences subjective distress...is more likely to process self-relevant information in a relatively unbiased and balanced fashion" (Taylor & Brown, 1988, p. 196). Contrary to advocates of accurate self understanding, "unrealistically positive self-evaluations, embellished perceptions of control and mastery, and unrealistic optimism - can serve a wide variety of cognitive, affective, and social functions" (Taylor & Brown, 1988, p. 193).

Implications for Research on Learning Disabilities

The preceding discussion of self-efficacy theory suggests that optimistic perceptions of self-efficacy are desirable. However, Bandura (1989b) provides two caveats to overestimation: (a) extreme overestimation is maladaptive (e.g., believing that one is always correct), and (b) if the consequences of overestimation are catastrophic to others, it is maladaptive (e.g., believing that one can drive safely after drinking several glasses of wine). However, if personal attributes make success unlikely, defense mechanisms may be drawn upon to preserve self-efficacy (Taylor & Brown, 1988).

Definition of Learning Disabilities

Learning disabilities is a very complex concept. Students may display learning disabilities in quite different academic areas. The term refers to difficulties in processing that are sufficiently severe that students require special interventions. Even when they receive such assistance, students with LD find that academic achievement in their areas of deficit is very demanding. Because deficits manifest themselves in a variety of areas, a comprehensive approach to diagnosis using a battery of formal and informal tests is repeatedly urged in the literature (Hoy et al., 1966, Hawks, 1966). Three general approaches to identifying learning disabilities have been considered in the literature: cut-off scores, discrepancy measures, and clinical models. Siegel (1986, 1990) has proposed that students be identified as reading disabled if they fall below the twenty-fifth percentile on the reading subtest of the

WRAT-R. This procedure can be justified when the purpose of a study is to investigate correlates of single word decoding, particularly when, as in much of Siegel's research, students below an IQ of 85 are omitted, and so low performance on the reading subtests can not be attributed to low IQ. Although Siegel's article has been strongly debated, much of the criticism has been directed to assumptions that she made about the IQ.

The second approach by which learning disability is identified is by a discrepancy between cognitive ability (usually IQ) and some measure of achievement. Stanovich (1991) has discussed theoretical and empirical difficulties in the use of such methods. He expresses particular concern about the use of such measures when diagnosing reading disability because the influence of reading on aptitude measures undermines "the notion of discrepancy by weakening the distinction between aptitude and achievement" (p.275).

The third approach, the clinical model, incorporates case history and personal background along with the results of diagnostic tests. This model has been proposed because it permits "the integration of norm-referenced tools as well as dynamic assessment methods" (Hoy et al., 1996, p. 65). Clinicians can therefore practice a form of ecological assessment in which they evaluate students in their contexts of environmental challenge.

In this study, students with LD were obtained from the Study Skills Clinic at O.I.S.E. where the clinical method is used to determine whether students have a learning disability.

Students are seen for two days of assessment, during which background information is obtained and a variety of tests are administered. The decision that a student has a learning disability that is sufficiently serious to justify some special accommodation is therefore based upon considerable knowledge. Students who have been diagnosed as manifesting LD may have deficits in quite different areas, but they will have experienced considerable difficulty in academically-related tasks. Therefore, although their areas of disability may differ, it can be expected that in the broad area of verbal academic adjustment they would display emotional and attitudinal reactions associated with persistent academic difficulty.

In academic situations, individuals with LD face intractable demands, and the nature of their disabilities often makes tasks exceedingly difficult. Ongoing evaluations ensure continual analysis of their deficits, thereby hindering avoidance and strategies which might circumvent exposure to negative academic and social evaluation. Some students drop out of school, but others persist despite such setbacks. One possible outcome of continually experiencing the consequences of poor performance might be to develop realistic efficacy expectations -- accepting one's weaknesses without minimizing them. Expectations would therefore be congruent with performance outcomes. Another reaction might be to form an acknowledged pocket of incompetence (Taylor & Brown, 1988) where efficacy expectations might even be unrealistically low, while simultaneously maintaining fairly high illusions outside this limited area. We might therefore find that people with LD have either unrealistically low or realistic estimates in areas perceived as unavoidable deficits, but outside these areas they might maintain optimistic self-appraisals.

Measurement of Self-Efficacy

Schunk (1985, 1989) has employed a pre-post test design to measure perceived self-efficacy. Students are shown examples of specific academic content (e.g., subtraction problems) and predict their certainty of solving each problem. An index of persistence is determined by having students estimate how long they would take to solve a related test. Skill level is measured by an obtained score using subtraction questions. Next, students receive the treatment associated with the content area. Afterwards, posttests for judged self-efficacy, persistence, and performance are administered and pre- and post-test results are compared. In order to assist students with LD, task engagement variables such as motivation, educational programs, skill training, and cognitive processes enhancing self-efficacy for learning are recommended (Schunk, 1989).

Much of Bandura's research has been focused upon measuring subjects' absolute ratings of ability (whether a particular question will be passed or failed) to determine whether change in efficacy levels occurs as a result of treatments. However, he also asserts that social comparison of ability influences efficacy (Bandura, 1990). In order to maintain self-efficacy, a relative comparison may be crucial, and the proper selection of a reference group may be necessary for a healthy level of self-efficacy. Bandura (1990) states that self-appraisal arises from different sources of comparative information. Normative (beliefs about one's own ability relative to the same aged group), social (beliefs regarding social demands and expectations), and personal ability (interpretation of personal events and feelings of satisfaction) are important criteria for judgment of ability. In school, normative information of one's ability relative to the rest of the class tends to be the accepted manner of feedback to students (although social and personal perceptions of ability are no less important). All of this information influences students' levels of self-efficacy. Teachers and students make daily normative appraisals, and students who cannot meet them "suffer the greatest losses in perceived efficacy" (Bandura, 1990, p. 353).

Sternberg (1990) argues that competence is not a fixed entity and that the ability to control the environment to benefit oneself as well as one's motivation is a crucial indication of competence. This form of practical intelligence may be more revealing than a more traditional method (e.g., mark on an exam) and competence should be measured by ability to operate successfully within one's environment, rather than by evaluation through using a static test procedure. He emphasizes the central role of people's ability to adapt to, to select, and to shape their environments.

Shafrir (1994) was influenced by Bandura's, as well as Sternberg's insights. He developed and pilot-tested a procedure for comparing self-estimates with actual test scores in two tests: (a) the Wechsler Adult Intelligence Scale-Revised

(WAIS-R) and (b) the Wide Range Achievement Test-Revised (WRAT-R). Together these tests contain a variety of ability and achievement subtests. Both tests are normed, and so raw scores can be transformed into standard scores with a mean of 100 and standard deviation of 15. Using standard scores permits profile analyses through comparing perceived and actual scores on various subtests. Subtests from the WAIS-R were used because in addition to measuring a general intellectual component "factor analyses of the...Wechsler Scales yields a robust first Verbal Factor and a slightly less robust but quite strong Performance Factor". A third factor, "(Memory/Freedom from Distractibility) occurs or is replicated often enough...to merit serious continued interest" (Matarazzo, 1972, pp. 273-274). The WRAT-R test was chosen because it is a widely-used measure of academic achievement in three important areas: Reading, Spelling, and Arithmetic.

Research on Learning Disabilities and Academic Self-Concept

A literature search did not reveal studies dealing directly with self-efficacy measures using adults identified as learning disabled (LD). However, many studies have explored the self-concepts of adults with LD. Although most of these studies use omnibus tests and general surveys whose validity Bandura criticizes, their results have implications for assisting people with LD.

Studies of adults with LD have yielded relations between academic adjustment and self-concept (e.g., Hughes & Smith, 1990; Johnston, 1985; Saracoglu, Minden, & Wilchesky, 1989). Adults with LD report difficulty reading, writing, and computing arithmetic persisting into adulthood and increasing in severity (Hughes & Smith, 1990; Johnston, 1985). Johnston found that adults with reading disabilities developed sophisticated questioning, listening, and speaking strategies to compensate for being unable to read or write reports.

Academic areas presenting difficulty for students with LD. Hughes and Smith (1990), in a thorough literature review, found a dearth of research investigating the needs of students with LD. They reported that the subtest profiles of students with LD on the WAIS-R were more variable than those of NA students but that the full scale means of the two groups were indistinguishable. Reading, writing, and arithmetic were consistently cited as serious achievement-related problems by students with LD, indicating that there is a need for academic accommodations at the university level. Several suggestions were made by Hughes and Smith. First, diagnosing LD is difficult because most tests were not designed, nor were they normed, on large university samples of LD students, making test interpretation particularly difficult. Therefore, new tests and sample norms should be tailored to the population with LD.

Second, informal measures, such as self-reports, are recommended for use in assessments to determine "perceived strengths, weaknesses, coping strategies, and learning style" (Hughes & Smith, 1990, p. 76) because students with LD typically can identify and describe their academic shortcomings. (In the present study the belief that one is or is not LD is an important classification criterion.) Third, they emphasize developing more effective, directed, specific treatments and remediation.

Saracoglu et al. (1989) examined social, emotional, and academic adjustment of university students with LD relative to their NA peers. In addition, general self-efficacy and general self-concept were measured. Analyses showed that students with LD had significantly lower levels of general self-efficacy, emotional, and academic adjustment to university than NA peers. Saracoglu et al. reported that students with LD are "motivated and persistent in striving for their goals, yet they do not display positive attitudes regarding their competence" (p. 592).

Design Limitations of Self-Estimates

Mabe and West (1982) performed a meta-analysis of ability self-estimates in which they investigated nine possible criteria to increase the accuracy of self-estimates. The criteria were:

(a) **match** between self-evaluation and ability, (b) **performance** rating (past or present behaviors), (c) **past** performance only, (d) **relative** self-evaluation ("use of 'better than average' or 'as compared to your fellow workers'" (p. 291)), (e) specific reference to a comparison **group,** (f) **distribution** of ability performance for comparison group given prior to self-evaluation, (g) **anonymity**, (h) **expectation** of validation, and (i) **experience** in self-evaluation. Four criteria which fostered reliable ratings were: (a) validation, (b) relative self-evaluation, (c) prior self-evaluation experience, and (d) anonymity. Each key recommendation is reviewed, and its implications for this study discussed.

First, subjects inflate ratings which they believe will not be validated (Mabe & West, 1982). In our study, subjects were informed that their self-estimates would be compared with their scores on the WAIS-R and WRAT-R.

Second, Mabe and West (1982) state that subjects should estimate their performance relative to a comparison group: "self-evaluation phrased in relative terms would be expected to correlate higher with criterion measures than would self-evaluation phrased in absolute terms" (p. 290). Strein (1993), in his review of advances in research on academic self-concept and self-perceptions, concurs and states that a promising strategy for use in measurement would be to examine frame of reference effects; that is, to investigate students' comparisons of their own ability relative to others. That way, one could determine the effects of relative comparison of students with LD. In our self-estimation tests, subjects were instructed to compare themselves to their age mates using clearly-defined scales that did not provide elaborately defined increments which might have created priming effects (Hogarth, 1987).

Third, Mabe and West (1982) suggest that subjects should have prior experience in self-estimation, stating that task familiarity leads to greater accuracy. With regard to our self-estimation task, experience with estimation was not a major concern. Instead, we were interested in estimated ability after students receive a specific explanation of the performance area and two example items. Instructions and guidelines for estimation were provided to assist subjects when rating.

Fourth, accurate estimates may be achieved through assuring anonymity. When raters believe that their estimates will likely be seen by others, they may not provide true ratings of ability. In the present study, subjects were guaranteed anonymity; testing was conducted in private rather than in a group, and confidentiality of records was promised.

Mabe and West (1982) qualify their belief that veridicality is important for self-estimation by stating that "other theoretical concepts could have equal applicability in this area, but to date, systematic, theory-guided research has been virtually absent in this area" (p.294). Self-efficacy theory as discussed by Bandura (1977, 1986) indicates that the tendency for people to overestimate may alter traditional beliefs that perceived scores should approximate obtained scores.

Questions to be Investigated

Judging from Bandura's theory of self-efficacy, I expect to find that:

(1) when predicted and observed scores are compared, the group with LD will provide either accurate estimates or underestimates of ability in its perceived deficit areas, whereas the NA group will tend to overestimate, and,

(2) in its perceived nondeficit areas, the response pattern of the group with LD will tend to resemble that of the NA group.

There is not a great deal of research comparing self-efficacy scores of post-secondary students with and without LD, and so significance tests will be nondirectional.

Overestimation, Underestimation, and Realistic Estimation

For the purposes of this study, (a) accurate (veridical) estimation was operationalized as no significant difference between predicted minus observed scores, (b) overestimation was defined as a significant positive difference between predicted minus observed scores, and (c) underestimation was defined as a significant negative difference between predicted minus observed scores.

CHAPTER TWO - METHOD

Subjects

Normally-Achieving Students

The normal contrast group was comprised of 40 normally achieving (NA) students (**n**=20 women, **n**=20 men). The mean age of the group was 26. Thirty-six students were tested by the author in 1996, and the other four were tested by a graduate assistant in 1994. The students had never received individual psychoeducational tests for learning disability, and they had never been placed in remedial classes in school. In addition, English was their first speaking and reading language. Each student was registered in a post-secondary institution in Southwestern Ontario. Students were paid twenty-five dollars for two and one-half hours of testing. Table 1 gives demographic information about students with and without LD. Of the forty NA students, 33 were enroled in an undergraduate program, and seven were in graduate programs. Twenty-six students were enroled in Social Sciences and Arts programs, eleven were in Applied Science, and three were in Business.

Students with Learning Disability

The students with LD were tested by doctoral students from the years 1990 to 1994 at the Adult Study Skills Clinic at O.I.S.E. whose mission is to assist post-secondary students who have special needs. Clients were referred due to severe learning problems or due to a history of learning problems. They completed a battery of tests to determine whether a learning disability existed. In addition to normed, static measures based upon formal tests, dynamic-interactive assessment

Table 1

Demographic Information of Groups with and without LD

	NA	LD
Program Enrolment		
Social Sciences and Humanities	26	46
Science	11	16
Business	3	6
Engineering	0	4
Physical Education	0	3
General Programs	0	15
Education	0	2
Degree Sought		
Undergraduate Degree	33	83
Graduate Degree	7	9
Gender of Students		
Male	20	51
Female	20	41
Mean Age of Students	26	26

procedures were employed. Three steps were used in assessment.

First, the specific nature of students' presenting problems were obtained through a learning history questionnaire. Second, formal and informal tests were administered at the Department of Applied Psychology by faculty members or by supervised, trained graduate students to identify client strengths and weaknesses. Third, a continuous reevaluation of students' needs, goals, and learning strategies occurred during remediation. A decision to diagnose a student as learning disabled was based upon a history of learning difficulties dating from public school and a judgment by the clinic that the performance was low in at least one academic area (e.g., reading comprehension, arithmetic, writing).

Criteria for inclusion. Students in the group with LD had to be identified by assessment at the Clinic. In order to assure that students were included who displayed some degree of disability in several of the 21 achievement tests that were administered, students had to score below the 40th percentile in three or more subtests. On average, the ninety-two students selected scored below the 40th percentile on seven subtests, and so there was a significant pattern of underachievement on academic tests. (Appendix A shows the number of students with LD who scored below the 40th percentile in various numbers of tests).

Applicants were not included if they reported primary emotional problems or if counsellors or psychiatrists indicated they had either acute or chronic emotional disorders affecting day-to-day functioning. In addition, applicants whose first language was not English were not used because their linguistic background might have hindered performance and interfered with accurate measurement of deficit areas. Students with four or more subtests missing were dropped. Finally, only students having IQs at or above 85 were included to control for difficulties in intellectual functioning not primarily associated with a specific learning disability (Shafrir & Siegel, 1994).

Ninety-two students with LD were retained (**n** = 41 women, **n**= 51 men). Like the NA group, the mean age of the group with LD was 26. Table 1 shows that eighty-three students were enroled in an undergraduate program, and nine were enroled in a graduate program. Forty-six students were in Social Sciences and Arts programs, sixteen were in Science, fifteen were in a General Bachelor's program, six were in Business, four were in Engineering, three were in Physical Education, and two were in the Bachelor of Education (B.Ed.) program.

Level of Disability in Group with Learning Disabilities

In order to develop measures of level of disability in students with LD, complete intercorrelations and an exploratory principal components factor analysis with a Varimax rotation of a number of achievement tests that had been used in assessment was employed. Factors emerging from this analysis containing variables that were scored for accuracy-of-response and that assessed recognized disability constructs were selected so that scores could be calculated for each subject with LD on each factor. Median splits of the group with LD were performed successively on each set of factor scores so that each student could be classed as greater than the median (GM) or less than or at the median (LM) on each factor score. Appendix B contains Tables showing means and standard deviations of the total group and for each subgroup for 21 tests.

Measures

Students with LD were first asked to complete a personal learning history questionnaire in which they described their academic problems and then performed a number of self-estimate, aptitude, and achievement tests. Table 2 shows presenting problems of students with LD.

Learning History Questionnaire

On the personal learning history questionnaire, students with LD reported the core problem which caused them to seek assistance. The core problem was defined as the one that students believed most hindered their learning and was the main reason they sought assistance. Of the 92 records examined, a definite pattern emerged. Table 3 shows that of the problems on the Learning History Questionnaire: (a) 42 students reported single word decoding, (b) 14 reported concentration, (c) 10 reported rate of cognitive processing (defined as needing extra time to process information and to perform tasks), (d) seven reported reading comprehension, (e) seven reported mathematics, (f) seven reported writing, and (g) five reported organization.

Self-Estimate Test

Bandura (1984) states that "in thought, the types of outcomes people anticipate depend largely on their judgments of how well they are able to perform in given situations" (p. 235). The Self-Estimate Test (Shafrir, 1994) is designed to measure

Table 2

<u>Presenting Problems of LD Students (n=92)*</u>

Presenting Problem	
Reading	62 (68)
Spelling	45 (49)
Arithmetic	50 (54)
Writing Essays	74 (80)
Speaking	15 (16)
Essay Exams	72 (78)
Multiple Choice Exams	31 (34)
Note Taking	23 (25)
Organization	33 (36)
Time Management	39 (42)
Concentration	38 (41)
Memory	53 (56)
Visual Processing	12 (13)
Anxiety	38 (41)

Note. Counts reported first; percentages reported in parentheses.

Table 3

Learning History Questionnaire; Self-Reported Core Problems of Students with Learning Disabled Students (N=92)

Core Problem Reported	Number of Clients	Percentage
1 Single Word Decoding	42	46%
2 Concentration	14	14%
3 Cognitive Processing	10	11%
4 Reading Comprehension	7	8%
5 Mathematics	7	8%
6 Writing Essays	7	8%
7 Organization	5	5%
	92	100%

students' judgments of how well they will perform on a variety of subtests each one of which has been described and has been illustrated by an easy and difficult example.

Students were instructed to estimate (a) their accuracy and (b) their speed of response in subtests of the WAIS-R and WRAT-R. This predicted relative performance was measured on a scale ranging from a low score (1) to a high score (19) with a mean of 10 (average performance) (see Appendix C for instructions and test). Kahneman and Tversky (1984) argue that "decision problems can be described or framed in multiple ways that give rise to different preferences" (p. 341), and therefore students were required to make relative rather than absolute appraisals. Although scores for each subtest were recorded for accuracy and speed, only accuracy scores were used in this study.

Examples that were shown to students to illustrate test items were based upon items in the WAIS, WAIS-R, and WRAT-R subtests, in addition to modified items (see Appendix D). Consistent with an important recommendation by Mabe and West (1982), students were asked to predict their performance relative to peers their own age. Predicted and observed scores were then transformed to the same scale so they would be commensurable. A standard score was used with M=100 and s=15. Predicted scores were then compared with observed scores to determine estimation level.

One easy and one more difficult example was given for each of the WAIS-R and WRAT-R subtests (Appendix E shows item difficulties for the WAIS). The subtests on which subjects predicted relative performance were Information, Picture Completion, Digit Span, Picture Arrangement, Vocabulary, Block Design, Oral Arithmetic, Object Assembly, Comprehension, Digit Symbol, and Similarities (for the WAIS-R); and Reading, Spelling, and Written Arithmetic (for the WRAT-R).

For each subtest, students were required to look at the "easy" and "difficult" examples, to think carefully about them, and, after reflection, to rate (a) how well and (b) how fast they believed that they could perform in comparison to their same-age group. (The exception is in the Digit Symbol subtest; due to the nature of the coding task, the entire template was displayed). Each set of examples will be briefly discussed and compared with the respective standardized test questions. The first 11 of the following are examples used in obtaining self-estimates on the WAIS-R subtests, whereas the last three are examples used in obtaining estimates on the WRAT-R subtests.

Information. The easy example was "Where does the sun rise?" whereas the starting question on the WAIS-R was "Where does the sun set?" The more difficult example was "Who were the Wright brothers?" On the earlier WAIS form, the comparable question was "Who invented the airplane?" and on the WAIS-R, "Who was Amelia Earhart?" On both forms, the comparable question used in the test was of moderate difficulty, appearing approximately halfway through the test.

Picture Completion. Students were told that Picture Completion involved identifying the most important element missing from pictures. The easy example was a picture of a die with one dot missing. This picture parallels Question 4 of 20 on the WAIS-R: a nine of diamonds playing card with a diamond missing. The more difficult example parallels WAIS-R Question 19 of 20. The example showed a man's profile, whereas on the WAIS-R a woman's profile was given. In both cases, the eyebrow was missing.

Digit Span Forwards and Backwards. These tests required listening to digit strings and repeating them aloud in order (Forwards) or in reverse order (Backwards). In both cases, the easy example was a three-digit string, and the more difficult example was a seven-digit string. The Digit Span estimate was calculated by adding the Forwards and Backwards accuracy estimates and dividing the sum by two.

Picture Arrangement. Students were told that the Picture Arrangement task required ordering single pictures to make a sensible story. The easier tasks had only a few pictures, whereas the more difficult tasks had several pictures to arrange. The easy example was "Elephant Riding the Elevator", which contains two cards. The WAIS-R first task "House", had three cards. The more difficult example was "Elephant Dressing". This sequence consisted of five cards. The comparable WAIS-R task was "Flirt", which also had five cards.

Vocabulary. Students were told that the purpose of the Vocabulary subtest was to define words. The easy and more difficult examples were the start and end questions from the Vocabulary subtest on the WAIS-R. The easy example was "What does breakfast mean?" and the more difficult example was "What does tirade mean?"

Block Design. Students were shown nine blocks and were told that the object of the task was to manipulate the blocks to copy designs drawn on cards. They were also told that easy designs consisted of four blocks and more difficult designs contained nine blocks. From the examiner's perspective, the easy example only differed in one way from the first WAIS-R pattern: the nearest block on the left had been rotated 180 degrees to the left to create a slightly altered design from the WAIS-R Question 1 of 9. The more difficult example, which used nine blocks, was similar to the design in Question 8 of 9, but contained a block that had been flipped from top to bottom and then rotated 90 degrees to the left.

Oral Arithmetic. Students were told that the Arithmetic subtest consisted of listening to word problems, thinking about them, and answering them aloud. The easy and more difficult examples were taken from Start Question 3 and Question 13 of 15 respectively of the WAIS-R. The easy example was "What is 4 dollars plus 5 dollars?" and the more difficult example was "A coat that normally sells for 60 dollars is reduced by 15 percent during a sale. What is the price of the coat during the sale?"

Object Assembly. The test administrator told students that the purpose of the task was to place pieces together to form an object or item. The easy example was a five-piece puzzle of Pinnochio; on the WAIS-R, the first and easiest object assembly task was a five-piece Mannequin. The more difficult example was a six-piece puzzle of a tiger, whereas the corresponding object assembly task on the WAIS-R was the sevenpiece puzzle of an Elephant.

Comprehension. Students were instructed to explain the meanings of sentences that the examiner would read aloud. The easy and more difficult examples were taken from the WAIS-R: the easy example was Question 2 of 16 and the more difficult example was Question 15 of 16. The easy example was "What is the thing to do if you find an envelope in the street that is sealed, and addressed, and has a new stamp?" and the more difficult example was "What does the saying mean, 'One swallow doesn't make a summer'?"

Digit Symbol. This was the only test in which one easy example and one difficult example was not provided. The test administrator explained that people had to observe a template in which the digits one to nine each had a matching symbol. They would then be required to write the correct symbol as accurately and as quickly as possible without skipping numbers and completing one number at a time. Students then viewed the Digit Symbol template briefly.

Similarities. Students were told that people were required to listen to sentences naming two elements and explain how these two things were similar or alike. The easy and more difficult examples were taken from the WAIS-R subtests. The easy example was "In what ways are an Orange and Banana alike?" (Question 1 of 14) and the more difficult example was "In what ways are a Fly and a Tree alike?" (Question 13 of 14).

In the last three self-estimates, students predicted relative performance on the WRAT-R subtests. Easy and more difficult examples were either taken from, or based upon, questions found in the Reading, Spelling, and Written Arithmetic subtests. Each of the examples will be briefly reviewed.

Spelling. Both the easy and more difficult examples were taken from the WRAT-R (the first and last questions on the subtest). The easy example was "cat" and the most difficult example was "iridescence".

Written Arithmetic. The easy and more difficult examples closely paralleled those found on the WRAT-R. The easy example was "6-3=?", whereas the second question on the WRAT-R subtest was "8-4=__". The more difficult example was: "Find the root of the equation: $3X^2-36X = 162$", whereas on the WRAT-R, the final question was "Find root: $2X^2-36X = 162$".

Reading. Students were told that the Reading task required people to read a list of words aloud. The easy and more difficult examples were taken from the WRAT-R. The easy example was "milk" which was the first word on the Reading subtest. The more difficult example was the word "regicidal".

Aptitude Test

Wechsler Adult Intelligence Scale-Revised. The WAIS-R was an aptitude test which provided obtained scores to compare with students' predicted scores.

Achievement Tests

Decoding. There were four decoding tasks: (a) the WRAT-R Reading subtest (WR), (b) the WRAT-R Spelling subtest (WSP), (c) the Woodcock-Johnson Word Attack subtest (WJ), and (d) the Phonological Word Task (PHA).

Wide Range Achievement Test-Revised, Reading and Spelling. In Reading, students read a list of real words aloud, and the examiner recorded the pronunciation of each item. In the Spelling subtest, the examiner read a word aloud, repeated the word in a sentence, and then repeated the word by itself. Students wrote the words.

Woodcock-Johnson Word Attack. This test contains a list of pseudowords (e.g., "vunhip"), and so mastery of letter-sound relations were required for pronunciation. The task tests the level of grapheme-phoneme correspondence (ability to sound out and decode unfamiliar letter combinations).

Phonological Word Task. The Phonological Word Task is a computer test developed by Shafrir (1994) to identify problems in sounding out nonwords. Twenty-six pairs of visually-presented pseudophonemes appear one at a time on the screen. The examiner stated that one of the nonwords sounded more like a real word than the other (e.g., saip, saif), and students were to identify which one sounded most like a real word (Appendix F gives the list of stimuli).

Reading Comprehension. Five tests were used which are intended to measure reading comprehension: (a) Nelson Denny Silent Reading Comprehension after 20 minutes (ND20), (b) Nelson Denny Silent Reading Comprehension completed at Own Time (NDO), (c) Gray Oral Reading Test-Revised, Passage Accuracy (GP), (d) Gray Oral Reading Test-Revised, Comprehension (GC), and (e) WAIS-R Vocabulary (V).

Nelson Denny Silent Reading Comprehension. The Nelson Denny test was developed to detect reading difficulties at the college level. Students were told to read passages silently and to answer multiple choice questions following each passage. Two measures were used. In the first measure, after twenty minutes elapsed, students marked where they were and continued until they completed the task. The extra time taken was recorded. Two comprehension scores were determined (a) accuracy after 20 minutes and (b) accuracy after task completion.

The Gray Oral Reading Test-Revised. The Gray Oral Reading Test-Revised was an oral reading comprehension task used in diagnosing oral reading problems. Students were given a brief cue about the main idea of a passage and then read it aloud. They were scored for accuracy of passage reading (GP). Students were then asked five multiple choice questions about each story. Performance on these questions was their comprehension accuracy (GC).

WAIS-R Vocabulary. Kaufman (1990) suggests that this subtest measures language development and reading ability, both in and out of school.

Arithmetic. Ability in arithmetic was measured by six tests (a) the WRAT-R Arithmetic subtest (WA), (b) the WRAT-R Arithmetic subtest with an extra ten minutes (WA10), (c) the WAIS-R Arithmetic subtest (A), (d) the Arithmetic Estimation Test (Shafrir, 1994) Number Matching Latency subtest (AENL), (e) Arithmetic Estimation Multiplication Accuracy subtest (AEMA), and (f) Arithmetic Estimation Multiplication Latency subtest (AEML).

WRAT-R - Arithmetic. The Arithmetic subtest was administered as part of the WRAT-R. The purpose of the subtest is to detect problems in written arithmetic. On the WRAT-R Arithmetic subtest, two scores are obtained: one is the number of questions answered correctly after the normed time of 10 minutes (WA) and the other is the number correct after an additional 10 minutes (WA10). Students were given an extra 10 minutes to determine whether problems with arithmetic were due to lack of arithmetic knowledge or to difficulty with speed of processing.

WAIS-R Arithmetic. The WAIS-R Arithmetic test is different from the WRAT-R Arithmetic task in that the WAIS-R deals with consumer-oriented calculation situations. Also, each item is timed separately; students solve problems mentally and provide answers verbally.

Arithmetic Estimation - Matching Numbers Latency, Multiplication Accuracy, and Multiplication Latency. The Arithmetic Estimation Multiplication task is a computerized test developed by Shafrir (1994). It measures students' ability to estimate answers to arithmetic problems. Both accuracy and latency scores were recorded. In a brief training session, students saw 3 and 4 digit numbers with a list of six alternatives (one number matched the target digit). Their task was to match the digit with one member of the list by moving the frame around their choice using designated computer keys on the number pad. Once they made their choice they were to press the Enter key so that the computer would proceed to the next question. In the second part of the training session, two-by-two digit multiplication problems were presented, again with six possible answers. Students were once again required to estimate which one of the alternatives was the answer to the target question. They were told to work as accurately and as quickly as possible and that both number matching and multiplication questions would be presented by the computer.

The Arithmetic Estimation Number Matching Accuracy score (AENA) was omitted because its distribution was severely truncated (**M**=.99, **s**=.03). The other three subtests were retained: (a) Arithmetic Estimation Number Matching Latency (AENL), (b) Arithmetic Estimation Multiplication Accuracy (AEMA), and (c) Arithmetic Estimation Multiplication Latency (AEML).

Print Exposure Test. Four subtests modified for computer administration by Shafrir (1994), based upon the Print Exposure test (Stanovich & West, 1989) were used: Print Exposure Authors (a) Accuracy (PXAA), Print Exposure Authors (b) Latency (PXAL), Print Exposure Magazines (c) Accuracy (PXMA), and Print Exposure Magazines (d) Latency (PXML).

The Print Exposure Test is a recognition test of literary awareness developed by Stanovich and West (1989). Originally a paper-and-pencil recognition test to measure accuracy of (a) author (PXAA) and (b) magazine (PXMA) recognition, it was modified by Shafrir (1994) for the computer. (For a more detailed description of the original test, see Stanovich & West, 1989). In the computerized version, applicants received 80 items on each of the subtests. Forty items were foils embedded within each section to control for socially desirable behaviour (falsely stating that stimulus items are recognized). In addition, latency times for (a) Authors (PXAL) and (b) Magazines (PXML) were obtained in the computer version.

Students read the instructions from the computer screen. In the first section (Authors) the computer screen displayed 80 names of popular authors, one at a time. If they recognized the author's name, students pressed the Yes key; if they were unsure of the name or did not recognize it, they pressed the No key. They were instructed not to guess; this behaviour would be detected because decoys were interspersed with actual popular writers and magazine titles. When they had finished the section, they were given the option to revise their answers, and if they chose to do so, the items were then repeated five at a time. There are 40 names of mass-marketed, popular authors (e.g., Isaac Asimov) and 40 names of authors writing for more specialized audiences (e.g., Isabelle Libermann). Scores were obtained for accuracy and latency.

The second set of stimuli, Magazines, was designed to measure out-of-school reading that was not in book form. The procedure in this subtest was analogous to the authors subtest. There were 80 items, 40 of which were well-known, popular magazines (e.g., **Newsweek**). The other 40 foils consisted of magazines having a low circulation (e.g., **Tools and Repair**). Scores were again obtained for accuracy and latency.

Stencil Superpositions. Four outcome measures from the Stencil Superpositions test (Shafrir, 1994; Shafrir, Ogilvie, & Bryson, 1990) are designed to measure metacognition: (a) accuracy of response (X), (b) mean response latency (XL), (c) post-failure reflectivity #1 (PFR1), and (d) post-failure reflectivity #2 (PFR2).

This computerized task is intended to measure visual-spatial perception of a variety of stencil shapes, speed of processing, and post-failure reflectivity. There were 60 trials. Each trial consisted of a target stimulus at the centre of the computer screen and a stimulus comprising a possible answer in the lower, right-hand side of the screen. The target stimulus consisted of three or four stencil shapes which, when superimposed, might or might not match the possible answer. An example of a stencil shape might be a circle within a square. Students were instructed to image the stencils superimposed over each other and then to decide whether the stencil shape at the bottom of the computer screen matched their mental construct. They indicated a correct match by pressing a designated Yes key and an incorrect match by pressing a designated No key.

Rules governed (a) order of mental superposition of stencils in the target stimuli and (b) opacity of colours in the target stimuli. With respect to order, the stencil on the far right was to be mentally superimposed onto the one to its left, the resulting combined image was then to be superimposed on the stencil to its left, and so forth, until all stencils in the target had been superimposed. With respect to opacity, shapes under black areas were visible, whereas shapes under coloured areas were hidden. Following practice trials, the test was administered beginning with targets with two stencils and continuing to targets with five stencils. Latencies between presentation and response were taken. Two outcome measures were obtained from this part of the test: (a) accuracy of response (X) and (b) mean response latency for all trials (XL).

As soon as students respond they receive a message indicating whether their responses are correct or incorrect;

they are told to indicate when they want the next item. A second latency response is taken indicating the time between students' receiving feedback and their request for the next item. This additional latency score permits two post-failure reflectivity scores. The first score (PFR1) relates the mean of latencies following failure to the mean of latencies following success (latency mean after failure/latency mean after success). The second outcome measure (PFR2) compares the mean of latencies following failure with the mean of latencies for all 60 trials (latency mean after failure/latency mean after all trials).

Criterion Measures

The criterion measures were the predicted and the observed scores for each of the subtests of the WAIS-R and the WRAT-R. The hypotheses imply differences between predicted and observed scores among groups on various subtests, and so the primary interest of the study is in interactions.

Procedure

All students were assessed individually in the Adult Study Skills Testing facilities. The NA Students responded to posters requesting subjects for a study (see Appendix G). Signs were posted in many areas of the campus (libraries, cafeterias, athletics centre, and social science, science, and humanities departments). Potential subjects responded by telephone, and if they met the criteria for inclusion they were given an appointment for assessment. Assessment results for students with LD had been obtained by Shafrir (1994) at the Adult Study Skills Clinic.

Thirty-six NA students met with the author, a supervised doctoral student from the Ontario Institue for Studies in Education who was enroled in the Applied Developmental Psychology Department. The general procedure for testing was explained, and a written document was provided outlining the procedures (see Appendix H). Students were assured anonymity. After giving their consent (see Appendix I), they completed a learning history questionnaire to confirm that they met the conditions necessary for the study. They then provided self-estimates of their ability in various subtests of the WAIS-R and WRAT-R. The WAIS-R and WRAT-R were next administered. Overall, the testing procedure took approximately two and one-half hours. This procedure paralleled the order of administration of tasks given to students with LD. Students with LD were administered a more comprehensive assessment battery so that a diagnosis could be determined. They received the additional tests following the Self-Estimate, WAIS-R, and WRAT-R tests.

CHAPTER THREE - RESULTS

Estimation of Missing Scores

All students with LD who had four or more achievement subtest scores missing were omitted from the study. To obtain estimates of missing scores in the remaining records, complete correlations were calculated among the achievement tests. A regression equation was then applied to estimate missing scores using as a predictor the variable having the strongest correlation to the missing variable. This procedure is considered by Marascuilo and Levin (1983) to be one of the less problematic of several that they discussed.

In the case of the Stencil Superpositions Test, it was not possible to estimate missing data. The only substantial correlations were with other subtests in the same test, and when one of the measures was missing, the other measure was also missing.

Development of Level of Severity Indices

Following estimation of missing data, two steps were taken in developing the level of disability scales for the group with LD. First, intercorrelations among variables were computed and an exploratory principal components analysis with a Varimax rotation was performed. Second, when it was found that a meaningful factor structure emerged from this analysis, the factors to be used as disability scales were identified. Sets of variables were selected to calculate the level of disability from each factor scale.

Preliminary correlational and principal components analyses. The variables used in the first analysis were:

WAIS-R, Vocabulary (V); WAIS-R, Arithmetic (A); WRAT-R, Reading (WR); WRAT-R, Spelling (WSP); WRAT-R, Arithmetic (WA); WRAT-R, Arithmetic after an extra ten minutes (WA10); Woodcock Johnson, Word Attack (WJ); Phonological Word Task, Accuracy (PHA); Arithmetic Estimation, Numbers Matching Latency (AENL); Arithmetic Estimation, Multiplication Accuracy (AEMA); Arithmetic Estimation, Multiplication Latency (AEML); Nelson Denny Reading Comprehension at Twenty Minutes (ND20); Nelson Denny Reading Comprehension, Own Time (NDO); Gray Oral Reading Test-Revised, Passage (GP); Gray Oral Reading Test-Revised, Comprehension (GC); Print Exposure, Authors Accuracy (PXAA); Print Exposure, Authors Latency (PXAL); Print Exposure, Magazines Accuracy (PXMA); Print Exposure, Magazines Latency (PXML); Stencil Superpositions, Accuracy (X); and Stencil Superpositions, Response Latency (XL).

A complete correlation and principal components analysis with Varimax rotation of these variables using the 92 selected students with LD was performed. In the principal components analysis, it was decided to rotate the first six components because six was approximately one-quarter of the number of variables.

Informal examination of the pattern of correlations indicated that there was a complex dimensional structure. This impression was supported by the exploratory principal components analysis. (Tables 4 and 5 show the complete correlations and the principal components Varimax rotation, respectively). Names of dimensions measured by each of the six rotated factors were inferred from the variables that loaded .45 or higher on

Table 4

Correlations Among Academic Subtests for Students with LD, (n=92)

	V	A	WR	WSP	WA	WA10	WJ	ND20
A	0.26							
WR	0.41	0.19						
WSP	0.43	0.24	0.78					
WA	0.28	0.48	0.27	0.31				
WA10	0.26	0.47	0.24	0.28	0.87			
WJ	0.30	0.37	0.57	0.48	0.20	0.18		
ND20	0.45	0.29	0.23	0.24	0.25	0.22	0.12	
NDO	0.42	0.10	0.18	0.12	0.26	0.34	0.03	0.47
GC	0.25	0.18	0.10	0.01	0.09	0.19	0.05	0.50
GP	0.32	0.23	0.42	0.35	0.15	0.18	0.20	0.56
AENL	0.03	-0.32	-0.03	-0.05	-0.42	-0.42	0.02	-0.12
AEMA	0.09	0.45	0.02	0.23	0.44	0.54	0.12	-0.02
AEML	0.01	-0.27	-0.16	0.01	-0.18	-0.17	-0.01	-0.38
PXAA	0.32	0.01	0.37	0.39	-0.03	-0.01	0.26	0.26
PXAL	-0.03	-0.25	-0.23	-0.12	-0.26	-0.22	-0.03	-0.23
PXMA	0.38	0.07	0.27	0.22	0.02	0.06	0.18	0.20
PXML	0.14	-0.23	-0.04	0.11	-0.11	-0.13	0.06	-0.20
X	-0.11	0.17	-0.32	-0.28	0.13	0.23	-0.19	-0.00
XL	0.19	-0.21	0.24	0.34	-0.09	-0.09	0.09	-0.01
PHA	0.09	0.07	0.38	0.38	0.06	0.02	0.40	-0.05

	NDO	GC	GP	AENL	AEMA	AEML	PXAA	PXAL
GC	0.31							
GP	0.23	0.78						
AENL	-0.01	-0.10	-0.08					
AEMA	0.08	0.03	0.05	-0.16				
AEML	-0.15	-0.26	-0.24	0.23	0.35			
PXAA	0.13	0.06	0.22	0.28	-0.00	-0.04		
PXAL	-0.15	-0.13	-0.11	0.31	-0.04	0.30	0.09	
PXMA	0.15	0.10	0.19	0.11	0.08	0.04	0.70	-0.03
PXML	0.05	-0.19	-0.11	0.36	0.04	0.44	0.09	0.62
X	0.18	0.22	-0.01	-0.20	0.33	0.02	-0.38	-0.01
XL	0.18	-0.10	0.04	0.11	0.01	0.26	0.13	0.09
PHA	0.03	0.00	0.18	-0.07	0.03	0.04	0.05	0.12

	PXMA	PXML	X	XL
PXML	0.11			
X	-0.16	-0.09		
XL	-0.10	0.35	-0.32	
PHA	-0.05	0.16	-0.05	0.13

Note. V - Vocab, A - WAIS-R Arith, WR - WRAT-R Read, WSP - WRAT-R Spell,
WA - WRAT-R Arith, WA10 - WRAT-R Arith + 10, WJ - Wood John,
ND20 - Nel Denny 20 min, NDO - Nel Denny own time,
GC - GORT Comp, GP - GORT Pass, AENL - Arith Estim Num Lat,
AEMA - Arith Estim Mult Acc, AEML - Arith Estim Mult Lat,
PXAA - Print Exp Auth Acc, PXAL - Print Exp Auth Lat,
PXMA - Print Exp Mag Acc, PXML - Print Exp Mag Lat,
X - Sten Super Acc, XL - Sten Super Lat, PHA - Phonol Word Task

Table 5

Factor Loadings of Exploratory Factor Analysis: Orthogonal

Rotation of Subtests Administered to Students with LD (n=92)

Subtests	Factor Loading on Rotated Factor Patterns					
	1	2	3	4	5	6
WAIS-R ARITHMETIC	0.56*	0.27	0.18	-0.37	-0.12	0.17
WRAT-R ARITH	0.80*	0.12	0.08	-0.17	0.25	0.10
WRAT-R ARITH10	0.82*	0.08	0.18	-0.14	0.28	0.04
ARITH ESTIMATE NUMBERS LATENCY	-0.52	-0.04	-0.11	0.35	-0.02	0.33
ARITH ESTIMATE MULTIPLICATION ACCURACY	0.72*	0.02	0.23	0.26	-0.10	0.10
WRAT-R READING	0.12	0.75*	-0.27	-0.11	0.28	0.20
WRAT-R SPELL	0.26	0.70*	-0.26	0.09	0.28	0.18
WORD ATTACK	0.14	0.77*	0.03	-0.01	-0.08	0.18
PHONOLOGICIAL WORD TASK	-0.04	0.77*	0.10	0.12	0.01	-0.16
STENCIL SUPER ACCURACY	0.24	-0.26	0.69*	-0.00	-0.02	-0.20
ARITH ESTIMATE MULTIPLICATION LATENCY	0.07	-0.09	0.00	0.77*	-0.17	-0.02
PRINT EXPOSURE AUTHORS LATENCY	-0.34	0.07	0.24	0.58*	-0.15	0.15
PRINT EXPOSURE MAGAZINES LATENCY	-0.21	0.14	0.09	0.81*	0.05	0.11
STENCIL SUPERP LATENCY	-0.03	0.22	-0.41	0.51*	0.41	-0.24
WAIS-R VOCABULARY	0.26	0.25	-0.06	0.15	0.50*	0.40
NELSONDEN	0.05	0.05	0.15	-0.36	0.69*	0.23
NELSONDEN EXTRA	0.21	-0.03	0.01	0.11	0.74*	0.02
GORT-R COMP	-0.08	0.11	0.48	-0.34	0.57*	0.09
GORT-R PASSAGE	-0.10	0.42	0.30	-0.30	0.57*	0.19
PRINT EXPOSURE AUTHORS ACCURACY	-0.06	0.19	-0.23	0.04	0.20	0.79*
PRINT EXPOSURE MAGAZINES ACCURACY	0.09	0.05	-0.05	0.03	0.10	0.87*

Note. Loadings with asterisks are greater than .45 and define component structure. Factors 1, 2, and 5 are Arithmetic, Decoding, and Reading Comprehension factors, respectively.

the factor.

Factor 1 was termed Arithmetic because it had variable loadings of .45 or above on A, WA, WA10, and AEMA. (The negative loading on the latency variable, AENL, is not inconsistent with this inference). Factor 2 was named Decoding, because it had high loadings on WR, WSP, WJ, and PHA. Factor 3 was termed Stencil Superpositions; its loadings, X and GC were primarily from the Stencil Superpositions Test. Factor 4 was named Latency because its four loadings AEML, PXAL, PXML, and XL subtests measured latency. Factor 5 was called Reading Comprehension because its loadings; V, ND20, NDO, GC, and GP all measured comprehension of words or sentences. Factor 6 was termed Exposure to Print, Accuracy because its loadings were on PXAA and PXMA. (In addition to this analysis a second Principal Components analysis was performed with Varimax rotation of the first six components. The seven WAIS-R subtests that were not used in the first analysis were included. Appendix J presents the Varimax rotation of this second analysis).

Three of these factors were of particular interest as possible measures of level of disability: Arithmetic, Decoding, and Reading Comprehension. First, each of these three factors had four or more loadings representing three separate tests which indicated that they measured constructs broader than variance specific to a single test. Second, all of these factors primarily measure accuracy of response. Finally, all three factors measure dimensions that have been identified as having theoretical and/or practical significance in the LD field. Hughes and Smith (1990) in their review stated that reading, writing, and arithmetic are consistently cited as problems by adults having LD. Arithmetic is a very common area of difficulty. Decoding and reading comprehension are of particular theoretical interest; Stanovich (1988) in proposing a phonological core variable difference effect, argues that inconsistencies exist in the results of studies of reading disabilities because the two types of designs are confounded. He recommends distinguishing clearly between decoding level (DL) measures which require intact phonological processing capabilities and comprehension level (CL) measures requiring a wide variety of subskills but not necessarily exceptional phonological processing for successful performance. Stanovich's two constructs resemble the Decoding and Comprehension factors that were found in the principal components analysis.

Selection of variables for disability scales. Variables that loaded .45 or higher on Arithmetic, Decoding, or Comprehension were considered for inclusion in scales to measure level of disability in each of the three areas. The variable, AENL, was omitted from the Arithmetic scale because it was a measure of latency of response rather than accuracy of response. The four remaining tests from Arithmetic, the four tests from Decoding, and the five tests from Comprehension were then analyzed using a principal components analysis with Varimax rotation in which the first three components were rotated. Table 6 shows the complete correlations of the 13 variables and Table 7 contains the related Varimax rotation of the principal components analysis.

For each student with LD, three factor scores were

Table 6

Table of Correlations for Group with LD (n=92)

	VOC	ARITH	READ	SPELL	ARITH	AR10	WRDATTACK	NELSDEN
ARITH	0.259							
READ	0.409	0.189						
SPELL	0.425	0.243	0.781					
ARITH	0.284	0.478	0.266	0.310				
ARITH10	0.255	0.471	0.236	0.284	0.872			
WRDATTACK	0.300	0.369	0.574	0.478	0.200	0.178		
NELSDEN	0.449	0.285	0.229	0.236	0.245	0.222	0.123	
NELSDEN EXTRA	0.415	0.103	0.176	0.124	0.256	0.344	0.030	0.467
GORT-R COMP	0.252	0.184	0.098	0.010	0.086	0.187	0.048	0.504
GORT-R PASS	0.318	0.229	0.416	0.345	0.151	0.183	0.200	0.561
ARITH EST MULTIPLICATION ACCURACY	0.088	0.450	0.017	0.229	0.436	0.539	0.119	-0.023
PHONOLOGICAL WORD TASK	0.091	0.073	0.379	0.382	0.057	0.023	0.399	-0.053

	NELSDEN EXTRA	GORT-R COMP	GORT-R PASS	ARITH EST MULT ACC
GORT-R COMP	0.313			
GORT-R PASS	0.234	0.761		
ARITH EST MULTIPLICATION ACCURACY	0.078	0.034	0.050	
PHONOLOGICAL WORD TASK	0.031	0.001	0.176	0.030

Table 7

Factor Loadings of Exploratory Factor Analysis: Orthogonal Rotation for Tests Administered to Students with LD (N=92)

Subtests	Factor Loading on Rotated Factor Patterns		
	FACTOR1	FACTOR2	FACTOR3
WAIS-R VOCABULARY	0.51*	0.21	0.37
NELSON DENNY	0.81*	0.12	0.06
NELSON DENNY EXTRA TIME	0.59*	0.23	-0.02
GORT-R COMPREHENSION	0.84*	-0.00	-0.07
GORT-R PASSAGE	0.80*	-0.10	0.28
WAIS-R ARITHMETIC	0.19	0.65*	0.19
WRAT-R ARITH	0.15	0.86*	0.13
WRAT-R ARITH10	0.20	0.89*	0.07
ARITHMETIC ESTIMATION MULTIPLICATION ACCURACY	-0.08	0.76*	0.02
WRAT-R READING	0.24	0.09	0.85*
WRAT-R SPELLING	0.15	0.23	0.81*
WOODCOCK-JOHNSON WORD ATTACK	0.04	0.17	0.76*
PHONOLOGICIAL WORD TASK	-0.07	-0.06	0.67*

Note. Loadings with asterisks are greater than .45.

calculated consisting of (a) the mean of the four variables in Arithmetic, (b) the mean of the four variables in Decoding, and (c) the mean of the five variables in Comprehension. Median splits of these factor scores were used to estimate level of disability in each of the three factors. Students therefore received a score of greater than the median (GM) or less than or equal to the Median (LM) on each of the Decoding, Reading Comprehension, and Arithmetic factors. Therefore, on Decoding, there was a less severe (GMD) and a more severe (LMD) subgroup, on Reading Comprehension there was a less severe (GMR) and a more severe (LMR) subgroup, and on Arithmetic there was a less severe (GMA) and a more severe (LMA) subgroup.

To determine whether there were significant relations among the three sets of disability scores formed by the median splits, a series of chi square independence tests were performed. For Decoding and Comprehension $\chi^2(1, \underline{N}=92)=2.78$, $\underline{p}>.05$; for Decoding and Arithmetic $\chi^2(1, \underline{N}=92)=1.09$, $\underline{p}>.05$; and for Comprehension and Arithmetic $\chi^2(1, \underline{N}=92)=3.52$, $\underline{p}>.05$. There were therefore no grounds for rejecting the hypothesis of independence between any pair of the Decoding, Comprehension, and Arithmetic subgroups formed by the median splits. (A table of correlations among the three factor scores and a 2 x 2 x 2 contingency table showing frequencies of students in combinations of the LM and GM categories are presented in Appendix K).

Overview of Analyses of Self-Efficacy Measures

A series of profile analyses was conducted to determine whether interactions among groups and scores and tests existed. Repeated measures analyses of variance were performed following a suggestion by Greenhouse and Geisser (1959) and Winer, Brown, and Michels (1991) that when tests to be compared are commensurable, repeated measures ANOVA is an appropriate procedure. Separate analyses were conducted on the WAIS-R and the WRAT-R because the standardized scores are derived from different norm groups and because one is an aptitude and the other is an achievement test.

In the main analysis, the predicted and observed scores were compared using the total group with LD (**n**=92) and the NA group (**n**=40). Supplementary analyses were then performed: the group with LD was split into a group that was greater than the Median (GM) and one that was at or less than the Median (LM) on each of the three factor scores and each pair was then compared with the NA group.

Comparison of NA group and total group with LD on self-efficacy. The main analysis consisted of a 2 (groups: NA vs LD) x 2 (perceived/observed scores) x 3 (tests) repeated measures analysis of variance (ANOVA) to examine the profiles from the WRAT-R and a 2 (groups) x 2 (perceived/observed scores) x 9 (tests) repeated measures ANOVA to examine the profiles from the WAIS-R.

Comparison of NA group and subgroups with LD. Following the initial analysis using the NA and total group with LD, three sets of supplementary analyses were performed by dividing the group with LD into GM and LM subgroups based upon median splits on each of the three factor scores. A 3 (NA, GM, LM groups) x 2 (perceived/observed scores) x 3 (tests) ANOVA for the WRAT-R, and a 3 (NA, GM, LM groups) x 2 (perceived/observed scores) x 9 (tests) ANOVA for the WAIS-R were computed where the GM and LM groups were based upon Decoding factor scores. The same two analyses were then conducted for groups based on the Reading Comprehension and Arithmetic factor scores.

Post-hoc tests. In order to reduce the risk of Type I error, overall ANOVAs were performed, and if the *F* tests were significant, post hoc tests were calculated. In the present study, the primary interest was whether NA students would tend to overestimate their performance whereas students with LD would tend to underestimate or have realistic estimates in areas where they were expected to have disabilities but otherwise resemble NA students' response patterns. Therefore, significant three-way interactions were expected. When significant three-way interactions were found, *t* tests were calculated comparing the means of perceived with observed scores, and the means were also plotted. The Bonferroni procedure was used to modify significance levels to adjust for the effects of multiple tests on the probability levels of *t*.

If the three-way interactions were not significant, the two-way interactions were examined. For example, in the two-way Tests by Groups interaction, Perceived and Observed scores were combined. Post hoc *t* tests comparing the NA and GM, the NA and LM, and the GM and LM groups on each test were conducted. For the two-way interaction of Perceived/Observed scores by Groups, the scores on all tests were combined. Post hoc *t* tests were conducted for the NA and GM, NA and LM, and GM and LM groups, comparing Perceived and Obtained scores. For the two-way interaction of Perceived/Observed scores by tests, all three groups (NA, GM, and LM) were combined. Perceived versus obtained **t** scores were compared for each level of test. In all of these **t** tests, the significance level was adjusted using the Bonferroni procedure.

Students with LD had approached the Clinic for assistance in reading, writing, and arithmetic, and reported long-standing difficulty in these areas. Performance tasks were not described as problems. It was therefore expected that students with LD would provide either underestimates or provide accurate estimates of ability in mainly verbal tasks (such as in the WRAT-R and verbal section of the WAIS-R) relative to the NA group, who would tend to overestimate (the first hypothesis). In tasks not directly related to verbal comprehension or expression but rather to perceptual organization (e.g., performance tasks in the WAIS-R) the students with LD would tend to have a similar response pattern to the NA group (the second hypothesis).

MAIN ANALYSES COMPARING NA GROUP AND TOTAL GROUP WITH LD ON SELF-EFFICACY

Self-efficacy on the WRAT-R

In the main analysis the perceived and observed scores were compared for the NA and for the total group with LD on the WRAT-R. The three-way interaction was significant ($F(2,260)=3.82$, $p=.02$), and so perceived and observed scores of the NA group and group with LD were compared on the Reading, Spelling, and Arithmetic subtests. Table 8 shows the means,

Table 8 Means, Standard Deviations, and *t* Tests Comparing Perceived with Observed Scores for NA and Total LD Group, WRAT-R

	NA (*n*=40)			LD (*n*=92)		
	Per	Obs	*t*	Per	Obs	*t*
Reading	119.88	113.93	2.53*	104.49	105.87	-0.89
	(17.00)	(05.19)		(18.96)	(12.49)	
Spelling	115.00	113.23	0.75	98.04	101.98	-2.55*
	(19.64)	(08.85)		(20.70)	(13.21)	
Arithmetic	110.63	108.30	0.99	101.66	96.45	3.37**
	(19.88)	(14.69)		(22.36)	(14.41)	

Note. Per = Perceived, Obs = Observed

Standard Deviations are in parentheses.

* $p < .05$

** $p < .01$

standard deviations, and t tests, and Figure 1 plots the means for each subtest.

In Reading, the NA group significantly overestimated its ability, whereas in the group with LD the perceived and observed scores did not differ significantly. These findings were consistent with the first hypothesis of the study. In Spelling, the NA students' estimates were not significantly different from their obtained scores. In comparison, the group with LD significantly underestimated spelling ability relative to actual performance. This finding was not as straightforward as the finding for Reading. Although the differences between the patterns of the NA group and the group with LD were in the expected direction, the NA group had been anticipated to overestimate. In Arithmetic, the results show that while the NA group provided accurate estimates of ability, the group with LD, in comparison, significantly overestimated its arithmetic ability. This finding is contrary to the first hypothesis.

Self-Efficacy on the WAIS-R

The three-way interaction was significant ($F(8,1040)=2.50$, $p=.01$), and so perceived and observed scores of the NA group and the group with LD were compared at each level of test. Table 9 shows the means, standard deviations, and t tests, and Figures 2 and 3 plot the means for the verbal and performance subtests, respectively.

Self-efficacy on the verbal subtests. In Information, both the NA group and the group with LD significantly overestimated. In Digit Span, NA students' estimated and observed scores were almost identical whereas students with LD

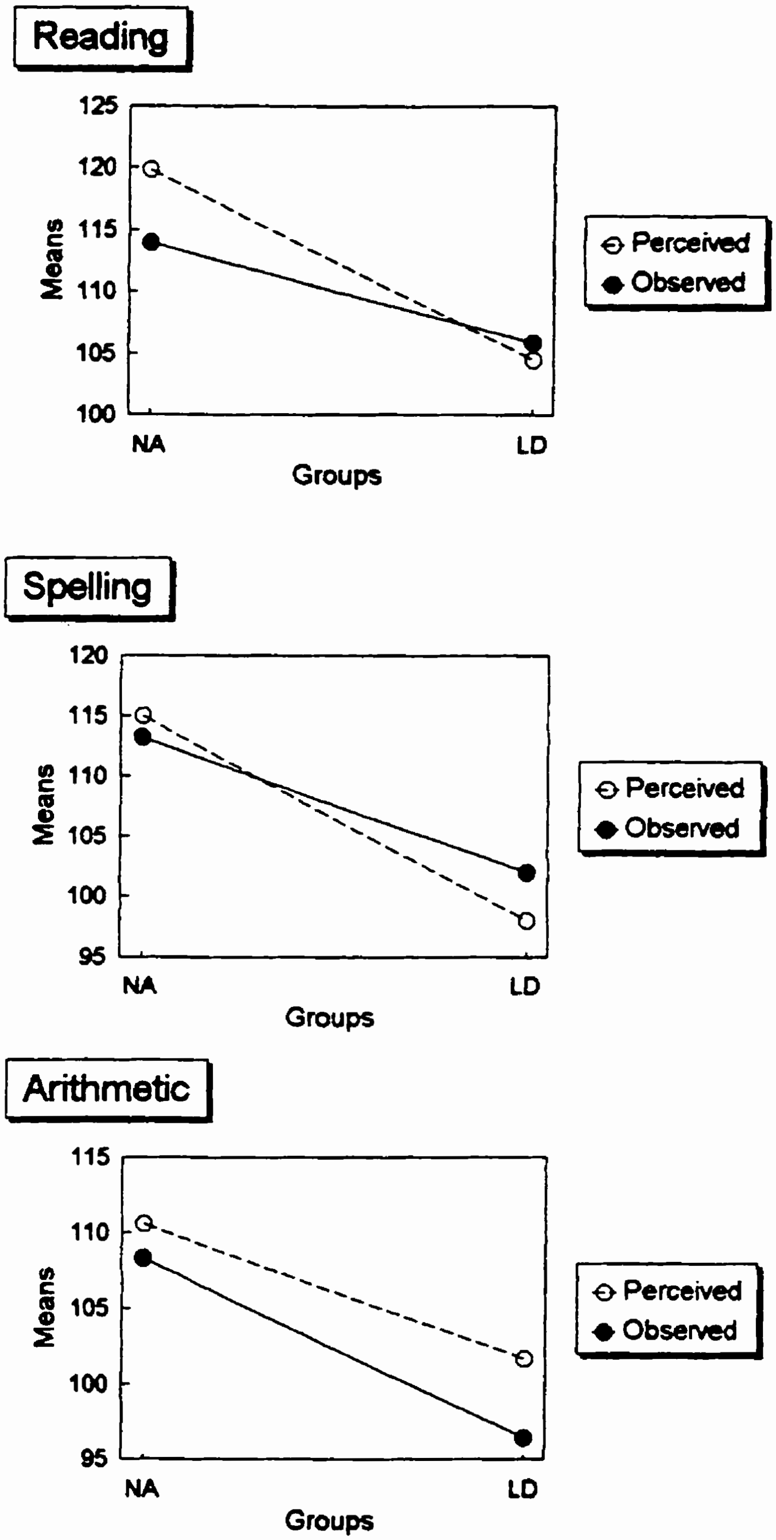

Figure 1. Means of perceived and observed scores for NA and total LD groups, WRAT-R subtests.

Table 9 Means, Standard Deviations, and *t* Tests Comparing Perceived with Observed Scores for NA and Total LD Group, WAIS-R

	NA (*n*=40)			LD (*n*=92)		
	Per	Obs	*t*	Per	Obs	*t*
Information	117.25	104.75	5.28**	112.66	102.83	6.29**
	(14.98)	(10.80)		(18.61)	(12.10)	
Digit Span	111.75	111.25	0.21	94.40	100.22	-3.73**
	(14.44)	(11.81)		(18.42)	(11.83)	
Vocabulary	117.88	107.75	4.28**	105.05	106.14	-0.70
	(16.64)	(11.60)		(17.70)	(11.17)	
Arithmetic	117.63	106.75	4.59**	99.24	100.22	-0.63
	(20.41)	(10.53)		(19.07)	(11.97)	
Similarities	113.88	107.75	2.59*	108.21	105.27	1.88
	(14.74)	(11.03)		(16.38)	(11.25)	
Pic. Comp.	112.13	99.25	5.44**	107.77	101.30	4.14**
	(12.90)	(10.41)		(16.20)	(11.81)	
Block Design	112.75	110.25	1.06	108.64	109.73	-0.70
	(19.45)	(11.21)		(19.61)	(15.56)	
Obj. Assembly	113.63	102.63	4.64**	113.32	104.08	5.92**
	(13.49)	(09.87)		(15.95)	(15.23)	
Digit Symbol	120.63	107.75	5.44**	114.08	99.08	9.60**
	(16.34)	(11.03)		(17.79)	(12.51)	

Note. Per = Perceived, Obs = Observed

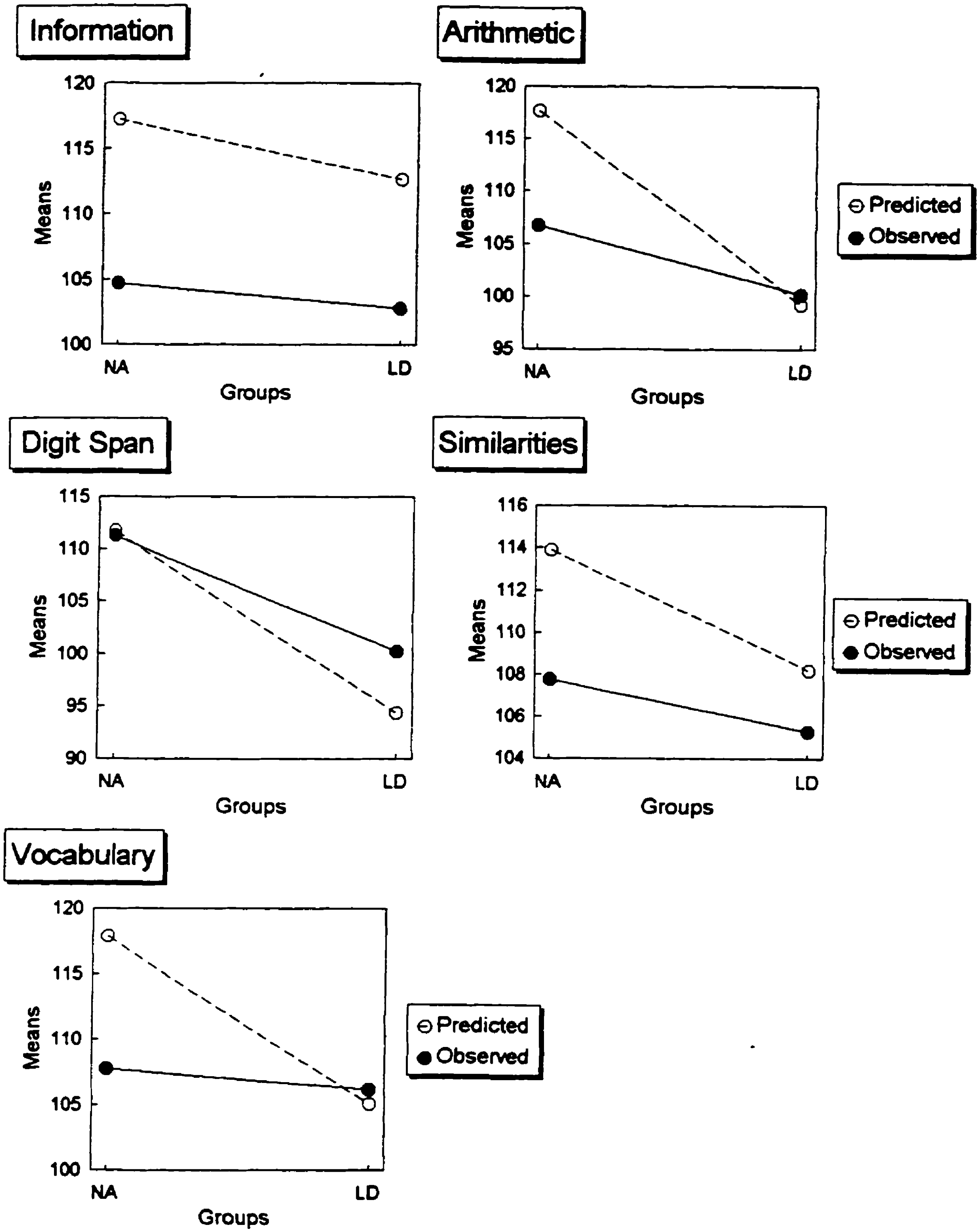

Figure 2. Means of predicted and observed scores for NA and total LD groups, WAIS-R verbal subtests.

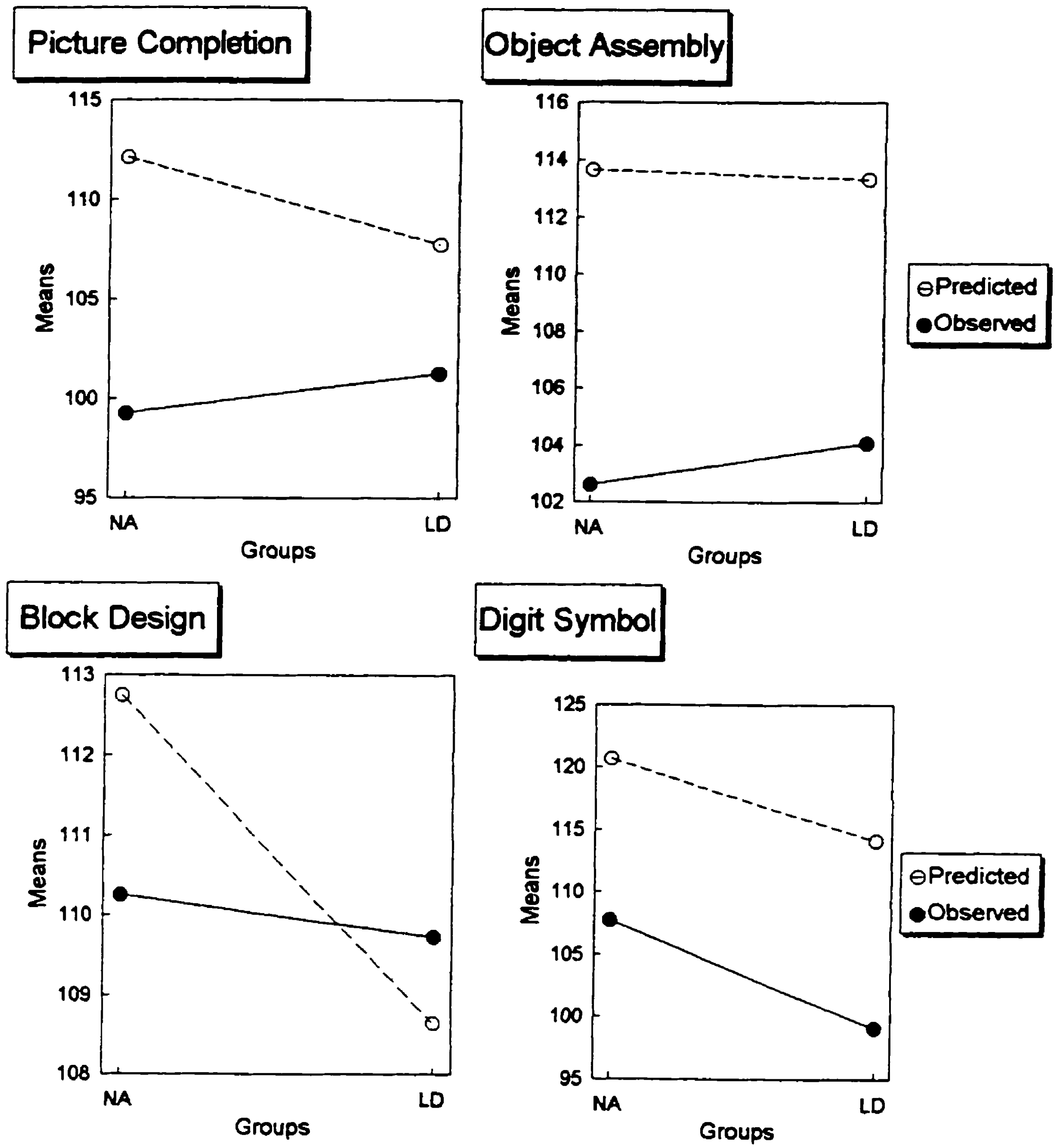

Figure 3. Means of predicted and observed scores for NA and total LD groups, WAIS-R performance subtests.

significantly underestimated. This finding showed that there was a trend in the expected direction. In the remaining three verbal subtests, Vocabulary, Arithmetic, and Similarities, as predicted, the group with LD provided realistic estimates of ability in comparison to the NA group which overestimated significantly.

Self-efficacy on the performance subtests. On the three performance subtests, Picture Completion, Object Assembly, and Digit Symbol, both the NA group and group with LD significantly overestimated. These results supported the second hypothesis. On Block Design, neither group differed significantly on its estimated and obtained scores. Both groups had realistic beliefs about their ability which was again consistent with the second hypothesis that the groups would not differ.

In this main analysis, the patterns of efficacy scores for the NA as compared to the total group with LD were largely consistent with expectations. It had previously been decided to investigate whether comparable patterns of self-efficacy would also emerge when median splits were used to classify members of the group with LD into high and low disability using the Decoding, Reading Comprehension, and Arithmetic factor scores.[1]

SUPPLEMENTARY ANALYSES COMPARING NA, GMD, AND LMD GROUPS ON SELF-EFFICACY

The first factor examined was decoding. The WRAT-R Reading and Spelling, the Woodcock-Johnson Word Attack, and the

Phonological Accuracy task comprised the decoding factor. A factor score for each student with LD was calculated by finding the mean on these four tasks. Next, students having factor scores greater than the median on decoding (GMD) were assigned to the group with mild LD and people having scores falling less than or at the median on decoding (LMD) were assigned to the group with severe LD. Analyses were performed using the NA, GMD, and LMD groups.

Self-Efficacy on the WRAT-R

The three-way interaction was significant $F(4,258)=4.38$, $p=.002$), and so perceived and observed scores were compared for the NA, GMD, and LMD groups on each subtest. Table 10 shows the means, standard deviations, and t tests, and Figure 4 plots means for the Reading, Spelling, and Arithmetic subtests.

Consistent with the first hypothesis, in Reading, the NA group overestimated, and, in comparison, the GMD and LMD groups had accurate estimates. In Spelling, the NA and GMD groups had realistic estimates, whereas the LMD group underestimated significantly. The fact that the NA group did not overestimate significantly was contrary to the hypothesis. In this case, the GMD group which had the less severe disability, like the NA group, had realistic efficacy, whereas the group with more severe disability had a lower level of efficacy. In Arithmetic, the LMD group significantly overestimated unlike the NA and GMD groups, whose perceived and obtained scores did not differ significantly. The overestimation of the LMD group and the accurate appraisals of

Table 10 Means, Standard Deviations, and t Tests Comparing Perceived with Observed Scores for NA Group and for GMD and LMD Groups Based Upon Decoding Factor, WRAT-R

	NA (n=40)			GMD (n=46)			LMD (n=46)		
	Per	Obs	t	Per	Obs	t	Per	Obs	t
Read	119.88	113.93	2.57*	112.72	114.30	-0.73	96.26	97.43	-0.54
	(17.00)	(05.19)		(18.03)	(07.40)		(16.24)	(10.73)	
Spelling	115.00	113.23	0.77	108.91	111.22	-1.07	87.17	92.74	-2.58*
	(19.64)	(08.85)		(17.85)	(05.08)		(17.50)	(12.35)	
Arith.	110.63	108.30	1.01	100.87	100.52	0.16	102.46	92.37	4.68**
	(19.88)	(14.69)		(21.74)	(15.44)		(23.18)	(12.16)	

Note. Per = Perceived, Obs = Observed

Standard Deviations are in parentheses.

GMD - Subgroup greater than median on Decoding Factor

LMD - Subgroup less than or at median on Decoding Factor

* $p<.05$

** $p<.01$

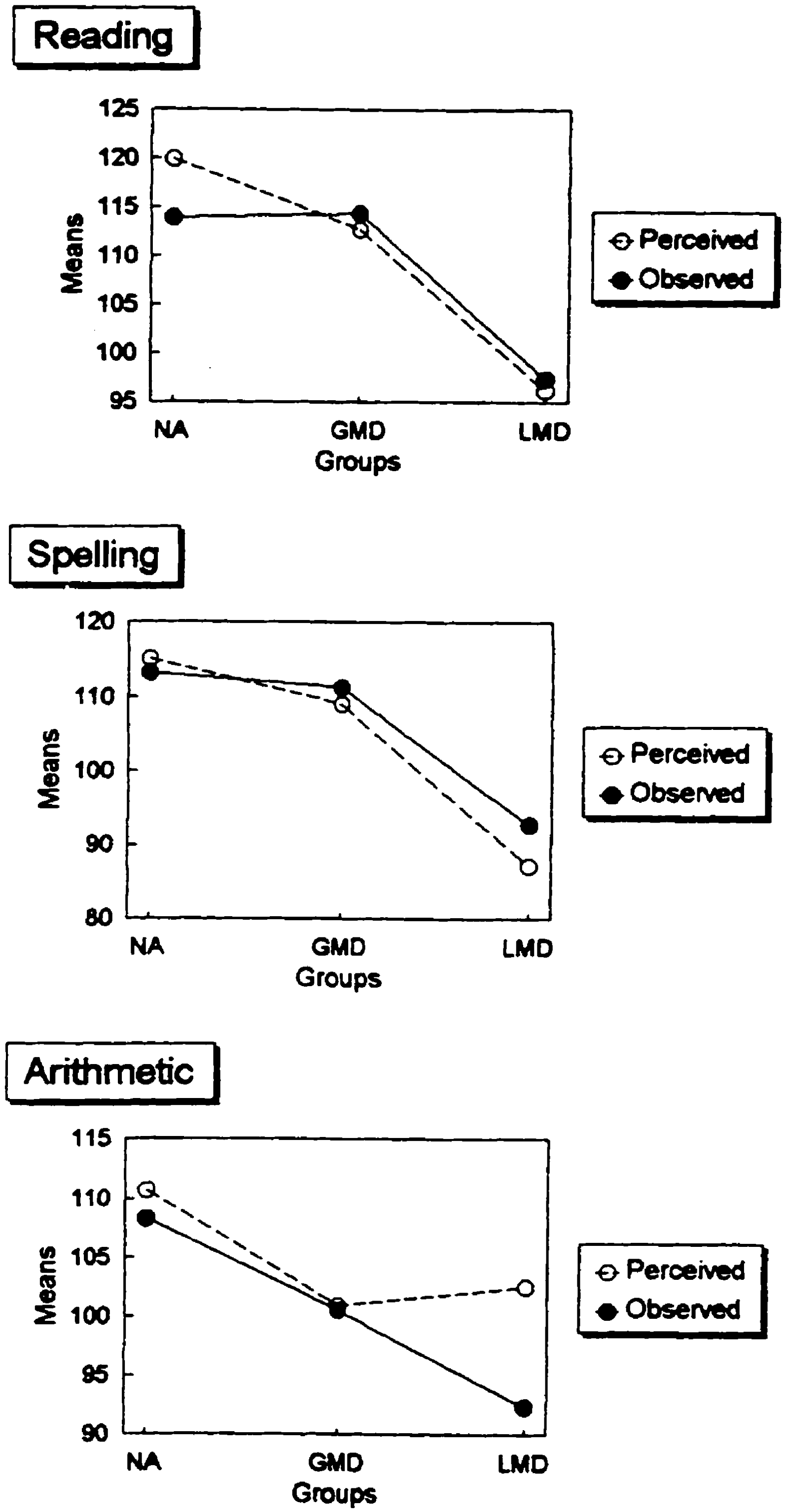

Figure 4. Means of perceived and observed scores for NA, GMD, and LMD groups, WRAT-R subtests.

* GMD - Decoding group greater than the median

** LMD - Decoding group less than the median the NA group were both contrary to the first hypothesis.

Self-Efficacy on the WAIS-R

The three-way interaction was significant ($F(16,1032)=2.00$, $p=.01$). Table 11 shows the means, standard deviations, and *t* tests. Figures 5 and 6 show the verbal and performance subtest means, respectively, for the NA, GMD, and LMD groups.

Self-Efficacy on verbal subtests. In Information, like the NA group, both the GMD and LMD groups gave significantly higher predicted than observed scores. The overestimation by the GMD and LMD groups was not expected. In Digit Span, the NA group had an accurate estimate as compared to the GMD and LMD groups who significantly underestimated. Although the difference in efficacy patterns between the NA group relative to the GMD and LMD groups was in the expected direction, it had been predicted that the NA group would overestimate. In both Vocabulary and Arithmetic the NA group overestimated relative to the GMD and LMD groups who both had realistic efficacy expectations. These results were as predicted. In Similarities, both the NA and GMD groups overestimated significantly while the LMD group's predicted and observed scores did not differ significantly.

Self-efficacy on performance subtests. In Picture Completion, Object Assembly, and Digit Symbol, the GMD and LMD groups, similar to the NA group, overestimated significantly. In Block Design, perceived and observed scores did not differ significantly in any of the three groups. This latter finding was consistent with the second hypothesis that in areas not

Table 11 Means, Standard Deviations, and t Tests Comparing Perceived with Observed Scores for NA Group and for GMD and LMD Groups Based Upon Decoding Factor, WAIS-R

	NA (n=40)			GMD (n=46)			LMD (n=46)		
	Per	Obs	t	Per	Obs	t	Per	Obs	t
Information	117.25 (14.98)	104.75 (10.80)	4.02**	114.24 (19.63)	104.67 (12.27)	4.34**	111.09 (17.60)	100.98 (11.77)	4.59**
Digit Span	111.75 (14.44)	111.25 (11.81)	0.21	97.50 (20.30)	103.15 (12.13)	-2.56*	91.30 (15.97)	97.28 (10.89)	-2.71*
Vocabulary	117.88 (16.64)	107.75 (11.60)	4.28**	110.87 (18.05)	109.57 (10.95)	0.59	99.24 (15.45)	102.72 (10.42)	-1.58
Arithmetic	117.63 (20.41)	106.75 (10.53)	4.60**	100.43 (20.16)	103.48 (13.24)	-1.38	98.04 (18.06)	96.96 (09.63)	0.49
Similarities	113.88 (14.74)	107.75 (11.03)	2.59*	111.74 (17.68)	105.33 (10.77)	2.91*	104.67 (14.31)	105.22 (11.83)	-0.25
Pic. Comp.	112.13 (12.90)	99.25 (10.41)	5.45**	105.33 (13.64)	99.67 (10.67)	2.57*	110.22 (18.23)	102.93 (12.76)	3.31**
Block Design	112.75 (19.45)	110.25 (11.21)	1.06	104.13 (18.69)	106.85 (13.84)	-1.23	113.15 (19.67)	112.61 (16.76)	0.24
Obj. Assembly	113.63 (13.49)	102.63 (09.87)	4.65**	111.85 (14.70)	100.65 (13.44)	5.08**	114.78 (17.16)	107.50 (16.25)	3.30**
Digit Symbol	120.63 (16.34)	107.75 (11.03)	5.45**	115.00 (18.47)	98.70 (12.93)	7.39**	113.15 (17.24)	99.46 (12.21)	6.21**

Note. Per = Perceived, Obs = Observed

Standard Deviations are in parentheses.

GMD - Subgroup greater than median on Decoding Factor

LMD - Subgroup less than or at median on Decoding Factor

* $p<.05$

** $p<.01$

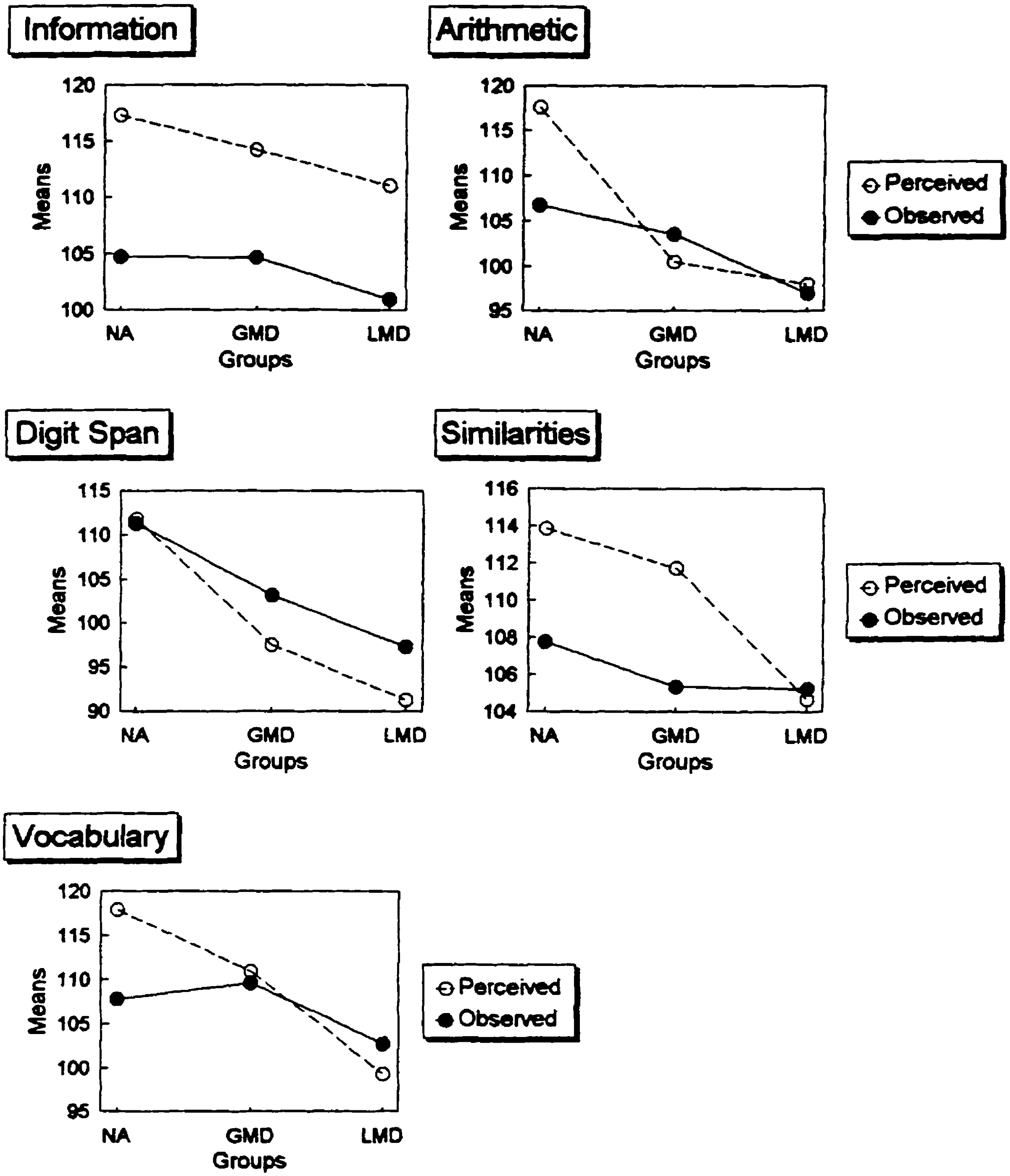

Figure 5. Means of perceived and observed scores for NA, GMD, and LMD groups, WAIS-R verbal subtests.

** GMD - Decoding group greater than median
** LMD - Decoding group less than median

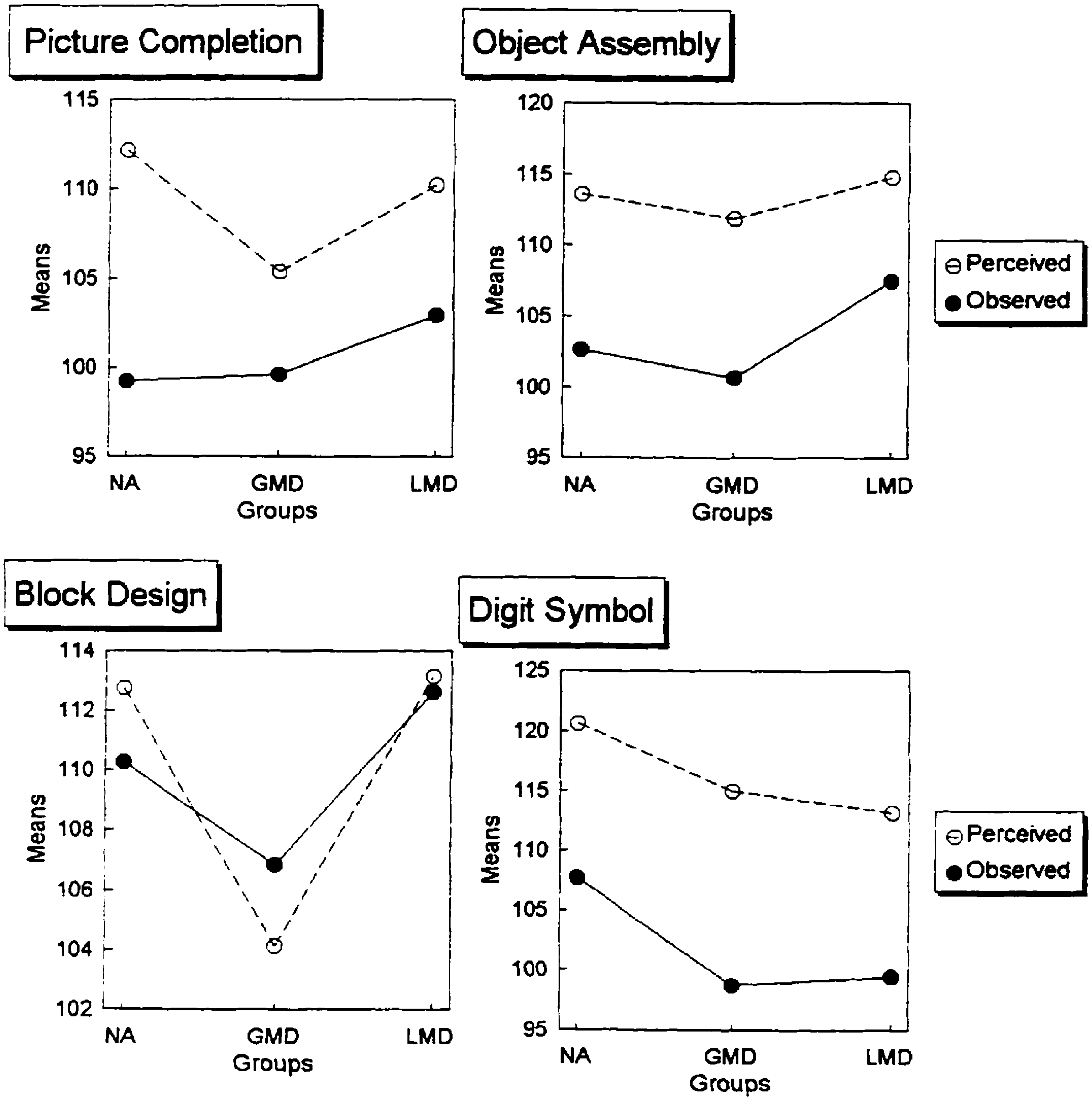

Figure 6. Means of perceived and observed scores for NA, GMD, and LMD groups, WAIS-R performance subtests.

* GMD - Decoding group greater than median
** LMD - Decoding group less than median

perceived as deficient, the response pattern of groups with LD would resemble that of the NA group.

SUPPLEMENTARY ANALYSES COMPARING NA, GMR, AND LMR GROUPS ON SELF-EFFICACY

The second factor examined was reading comprehension. The WAIS-R Vocabulary task, the Nelson Denny Comprehension at 20 minutes and with extra time, and the Gray Oral Reading subtests of Comprehension and Accuracy were the five subtests comprising this factor. The mean of these five tasks for each student in the group with LD was found. Students having means above the median in the reading comprehension factor score were assigned to the GMR group, and those having means falling at or below the median in the reading comprehension factor score were assigned to the LMR group. Analyses were performed comparing the NA, GMR, and LMR groups.

Self-Efficacy on the WRAT-R

The three-way interaction was significant $F(4,258)=2.40$, $p=.05$), and so perceived and observed subtest scores of the NA, GMR, and LMR groups were compared. Table 12 shows the means, standard deviations, and t tests, and Figure 7 plots the means for the three subtests.

As predicted, in Reading the NA group overestimated whereas both the GMR and LMR groups did not have significantly different perceived and observed scores. In Spelling, the GMR group significantly underestimated, whereas, the LMR and NA groups provided accurate estimates of ability. Contrary to

Table 12 Means, Standard Deviations, and *t* Tests Comparing Perceived with Observed Scores for NA Group and for GMR and LMR Groups Based Upon Reading Comprehension Factor, WRAT-R

	NA (*n*=40)			GMR (*n*=46)			LMR (*n*=46)		
	Per	Obs	*t*	Per	Obs	*t*	Per	Obs	*t*
Reading	119.88	113.93	2.53*	108.22	110.33	-0.96	101.76	101.41	0.16
	(17.00)	(05.19)		(19.80)	(09.43)		(17.51)	(13.63)	
Spelling	115.00	113.23	0.75	100.43	106.28	-2.67*	95.65	97.67	-0.47
	(19.64)	(08.85)		(22.36)	(10.40)		(18.84)	(14.38)	
Arith.	110.63	108.30	0.99	101.80	100.37	0.65	101.52	92.52	4.11**
	(19.88)	(14.69)		(22.95)	(12.58)		(22.00)	(15.18)	

Note. Per = Perceived, Obs = Observed

Standard Deviations are in parentheses.

GMR - Subgroup greater than median on Reading Comprehension Factor

LMR - Subgroup less than or at median on Reading Comprehension Factor

* $p < .05$

** $p < .01$

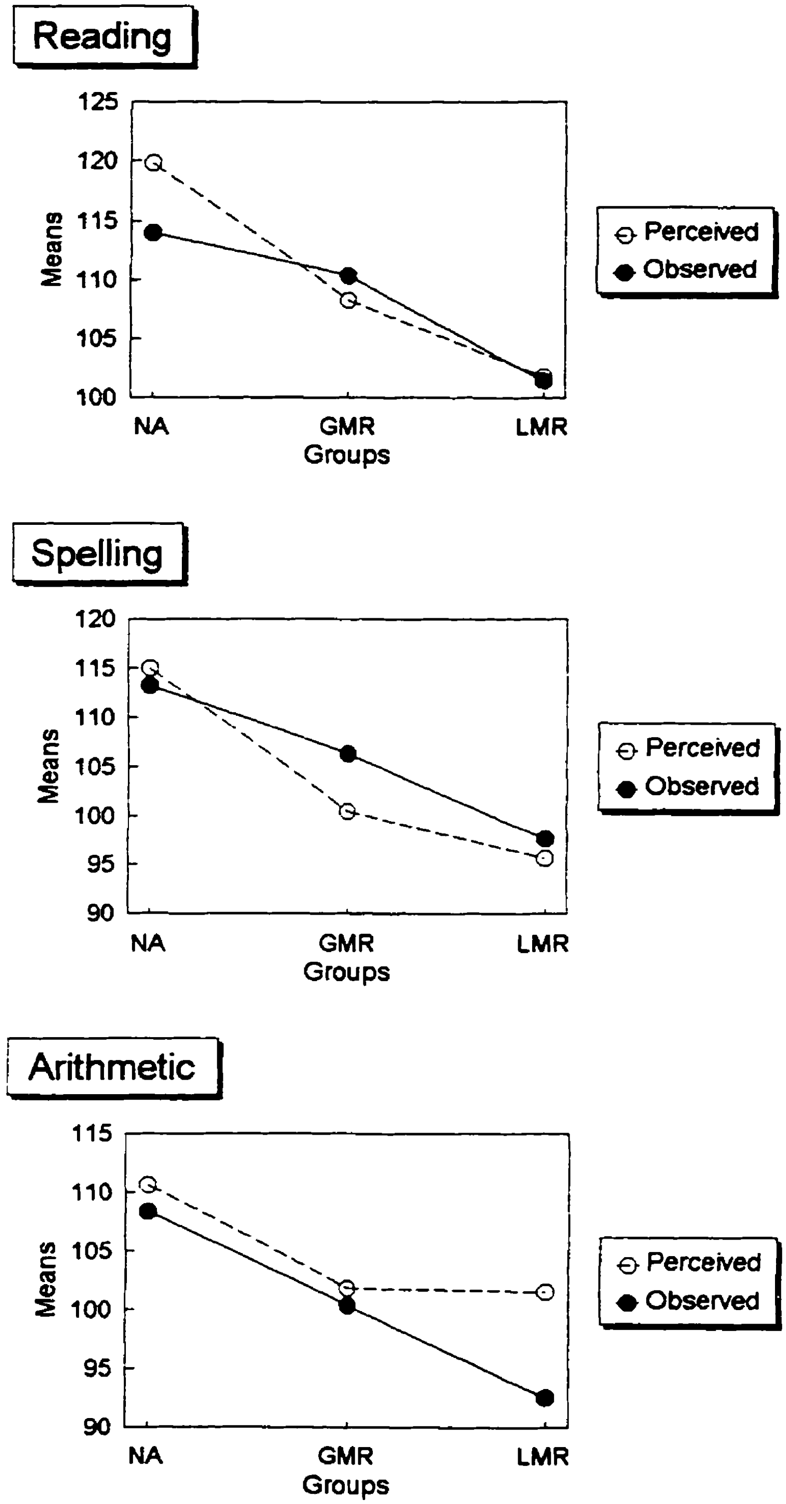

Figure 7. Means of perceived and observed scores for NA, GMR, and LMR groups, WRAT-R subtests.

* GMR - Reading Comprehension group greater than the median

** LMR - Reading Comprehension group less than the median expectations, the NA group did not overestimate and while the GMR group displayed a significant underestimation, the more severely disabled LMR group displayed realistic self-efficacy. In Arithmetic, the more severely disabled LMR group significantly overestimated its performance whereas the less severe GMR group, like the NA group, had realistic self-efficacy.

Self-Efficacy on the WAIS-R

The three-way interaction was not significant[2] ($F(16,1032)=1.43$, $p=.12$). However, there were three two-way interactions: Groups by Tests ($F(16,1032)=5.63$, $p=.001$), Perceived/Observed scores by Tests ($F(8,1032)=19.20$, $p=.001$), and Groups by Perceived/Observed scores ($F(2,129)=4.67$, $p=.01$). Table 13 shows the means, standard deviations, and t tests associated with the Groups by Tests interaction (for both verbal and performance subtests), and Figure 8 plots the means of the scores. Because this analysis averages predicted and observed scores it does not measure self-efficacy as such, but the findings will be discussed briefly. The NA group obtained significantly higher scores than the GMR group in Digit Span, Arithmetic, and Digit Symbol; however, test scores were not significantly different in any other tests. These three significant tests are members of the ACID subgroup (Arithmetic, Coding, Information, and Digit Span) that have been suggested as posing particular difficulty for LD groups. Kaufman (1990) states that this profile may be seen more frequently in younger children than in adolescents or adults; however, he does advise clinicians to look for the ACID profile when assessing adults

Table 13 Means, Standard Deviations, and t Tests Comparing NA Group with GMR and LMR Groups Based Upon Reading Comprehension, Combined Perceived and Observed Scores, WAIS-R.

	NA (n=80)	GMR (n=92)	t	NA (n=80)	LMR (n=92)	t	GMR (n=92)	LMR (n=92)	t
Information	111.00 (14.42)	111.58 (14.43)	-0.26	111.00	103.91 (17.43)	3.17**	111.58	103.91	3.56**
Digit Span	111.50 (13.11)	98.10 (15.40)	5.99**	111.50	96.52 (16.07)	6.70**	98.10	96.52	0.73
Vocabulary	112.81 (15.13)	110.82 (14.90)	0.89	112.81	100.38 (12.71)	5.56**	110.82	100.38	4.84**
Arithmetic	112.19 (17.04)	101.58 (16.47)	4.75**	112.19	97.88 (15.14)	6.40**	101.58	97.88	1.72
Similarities	110.81 (13.30)	109.13 (14.63)	0.75	110.81	104.35 (13.18)	2.89*	109.13	104.35	2.22
Pic. Comp.	105.69 (13.33)	103.42 (12.79)	1.02	105.69	105.65 (16.02)	0.02	103.42	105.65	-1.03
Block Design	111.50 (15.82)	108.86 (17.87)	1.18	111.50	109.51 (17.54)	0.89	108.86	109.51	-0.30
Obj. Assembly	108.13 (12.98)	108.70 (14.69)	-0.26	108.13	108.70 (17.71)	-0.26	108.70	108.70	0.00
Digit Symbol	114.19 (15.29)	104.84 (16.18)	4.18**	114.19	108.32 (17.86)	2.63*	104.84	103.82	0.47

Note. Per = Perceived, Obs = Observed

Standard Deviations are in parentheses.

GMR - Subgroup greater than median on Reading Comprehension Factor

LMR - Subgroup less than or at median on Reading Comprehension Factor

* $p<.05$

** $p<.01$

Tests by Reading Comprehension Group

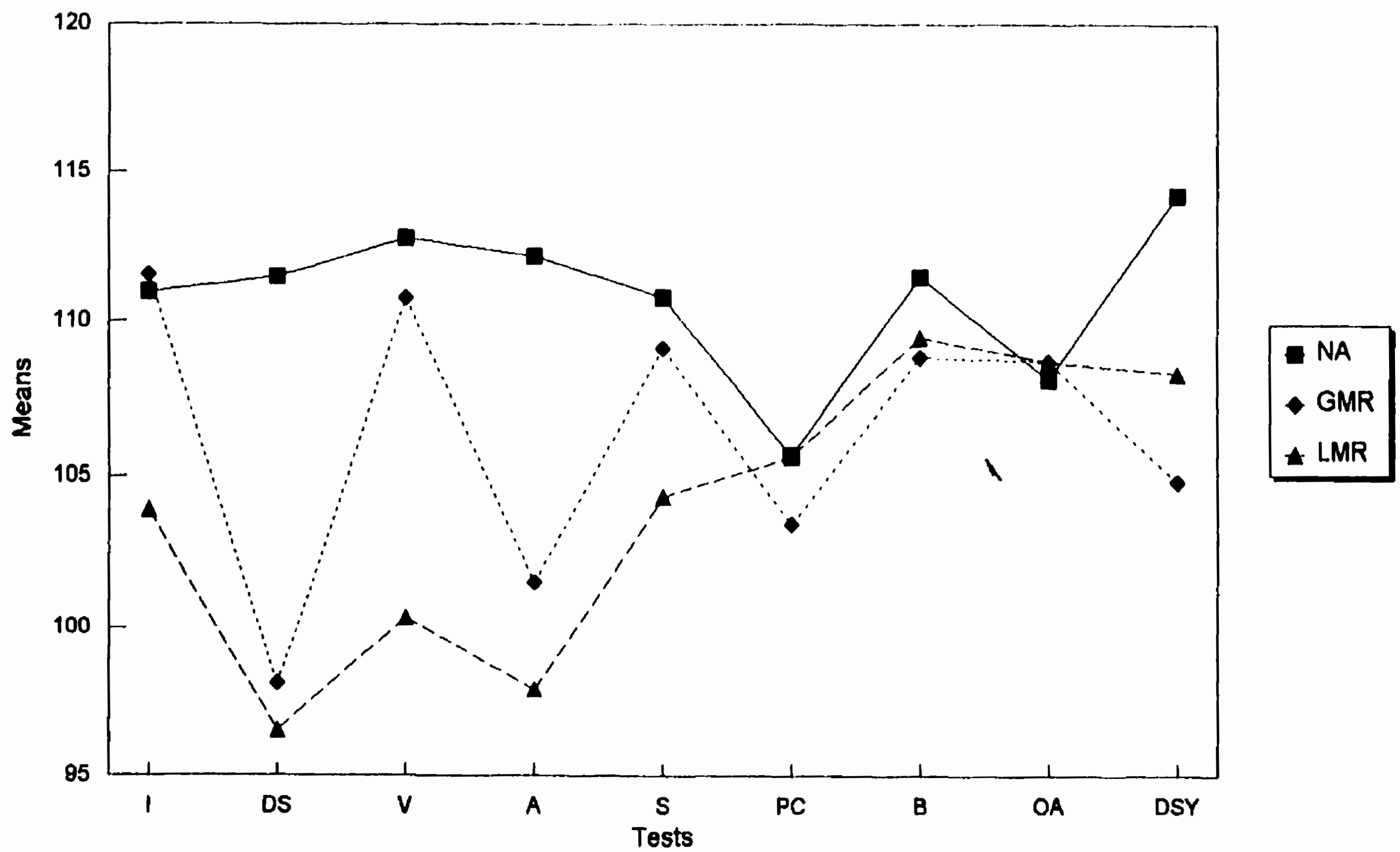

Figure 8. Means of NA group and GMR and LMR groups based upon Reading Comprehension factor, combined perceived and observed scores, WAIS-R.

* GMR - Reading Comprehension group greater than median
** LMR - Reading Comprehension group less than median

because it still may apply to some people with LD. The NA group obtained significantly higher means than the LMR group on these three tests (Digit Span, Arithmetic, and Digit Symbol), but the NA group also obtained higher means on the remaining three verbal subtests (Information, Vocabulary, and Similarities). The groups did not differ significantly in three of the performance subtests: Picture Completion, Block Design, or Object Assembly. In the comparison between the GMR and LMR subgroups, there were only two significant differences in means: Information and Vocabulary. In these verbal subtests the GMR group outperformed the LMR group. There were no significant differences between the two groups in performance subtests.

Table 14 and Figure 9 show that the interaction of Perceived/Observed scores by WAIS-R subtests is due primarily to overestimation by the pooled groups in three out of four of the performance tests (Picture Completion, Object Assembly, and Digit Symbol) as well as the tendency for the combined groups to overestimate in Information and Similarities and to underestimate in Digit Span.

Table 15 and Figure 10 show that the Perceived/Observed scores by Groups interaction is due primarily to the tendency of the NA and LMR groups to overestimate and for the GMR group to estimate accurately.

SUPPLEMENTARY ANALYSES COMPARING NA, GMA, AND LMA GROUPS ON SELF-EFFICACY

The third factor examined was arithmetic. The WAIS-R

Table 14 Means, Standard Deviations, and t Tests Comparing Perceived with Observed Scores for Total NA Group and Reading Comprehension Groups, WAIS-R

	Perceived (n=132)	Observed (n=132)	t
Information	114.05 (17.66)	103.41 (11.71)	8.14**
Digit Span	99.66 (19.02)	103.56 (12.83)	-2.98*
Vocabulary	108.94 (18.31)	106.63 (11.28)	1.77
Arithmetic	104.81 (21.18)	102.20 (11.90)	2.00
Similarities	109.92 (16.06)	106.02 (11.20)	2.98*
Pic. Comp.	109.10 (15.36)	100.68 (11.40)	6.44**
Block Design	109.89 (19.58)	109.89 (14.34)	0.00
Obj. Assembly	113.41 (15.20)	103.64 (13.80)	7.47**
Digit Symbol	116.06 (17.56)	101.70 (12.69)	10.99**

Note. Per = Perceived, Obs = Observed

Standard Deviations are in parentheses.

GMR - Subgroup greater than median on Reading Comprehension Factor

LMR - Subgroup less than or at median on Reading Comprehension Factor

* $p<.05$

**$p<.01$

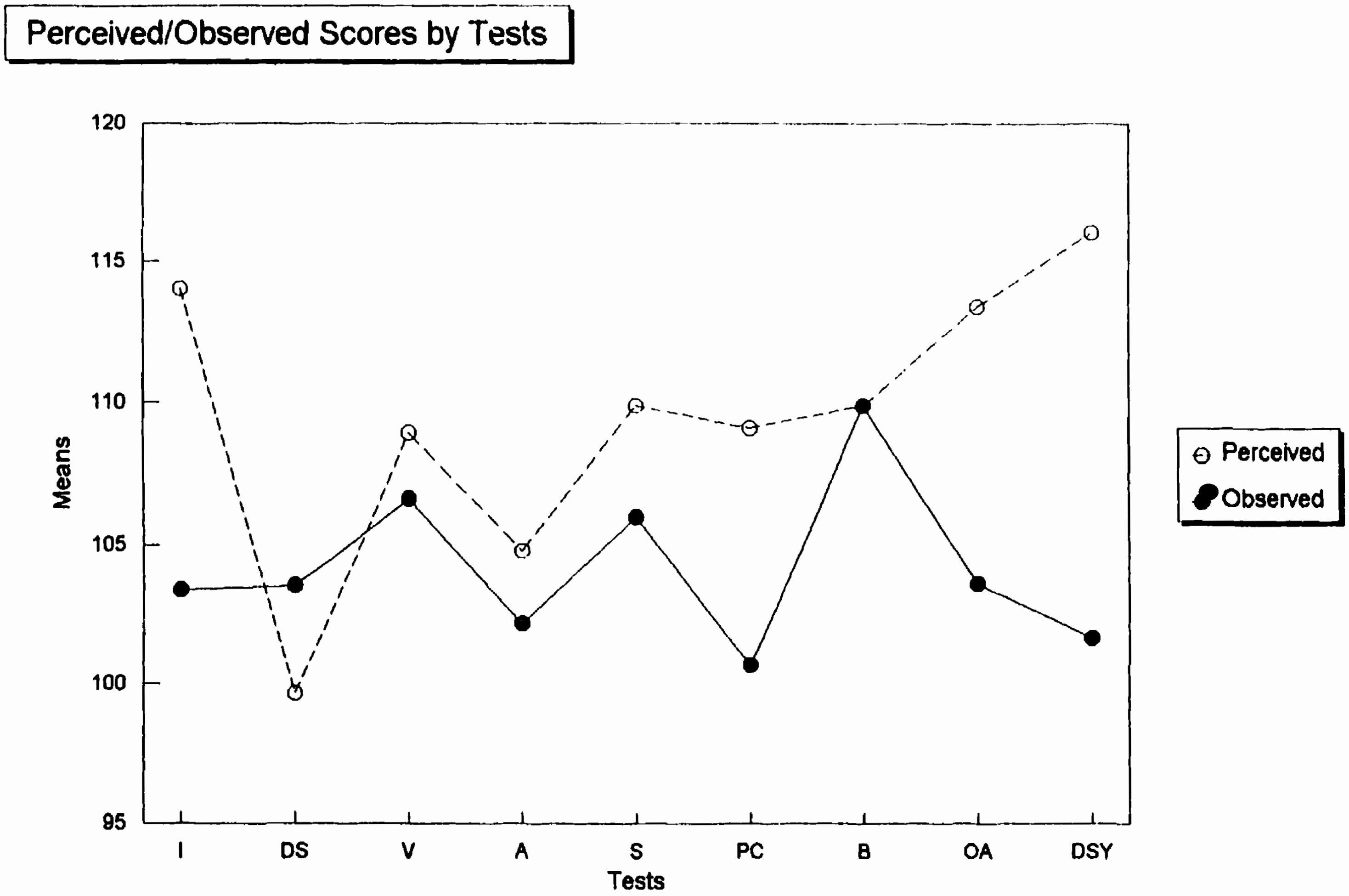

Figure 9. Means of perceived and observed scores for combined NA, GMR, and LMR groups based upon Reading Comprehension factor, WAIS-R.

* GMR - Reading Comprehension group greater than median
** LMR - Reading Comprehension group less than median

Table 15 Means, Standard Deviations, and t Tests Comparing Perceived with Observed Scores for Total NA Group and for GMR and LMR Group Based Upon Reading Comprehension Factor, Total of WAIS-R Scores

	Perceived	Observed	t
NA (n=360)	115.28	106.46	5.34**
	(16.20)	(11.38)	
GMR (n=414)	107.31	105.36	1.26
	(18.34)	(12.85)	
LMR (n=414)	106.78	101.05	3.72**
	(19.21)	(12.90)	

Note. Per = Perceived, Obs = Observed

Standard Deviations are in parentheses.

GMR - Subgroup greater than median on Reading Comprehension Factor

LMR - Subgroup less than or at median on Reading Comprehension Factor

**$p<.01$

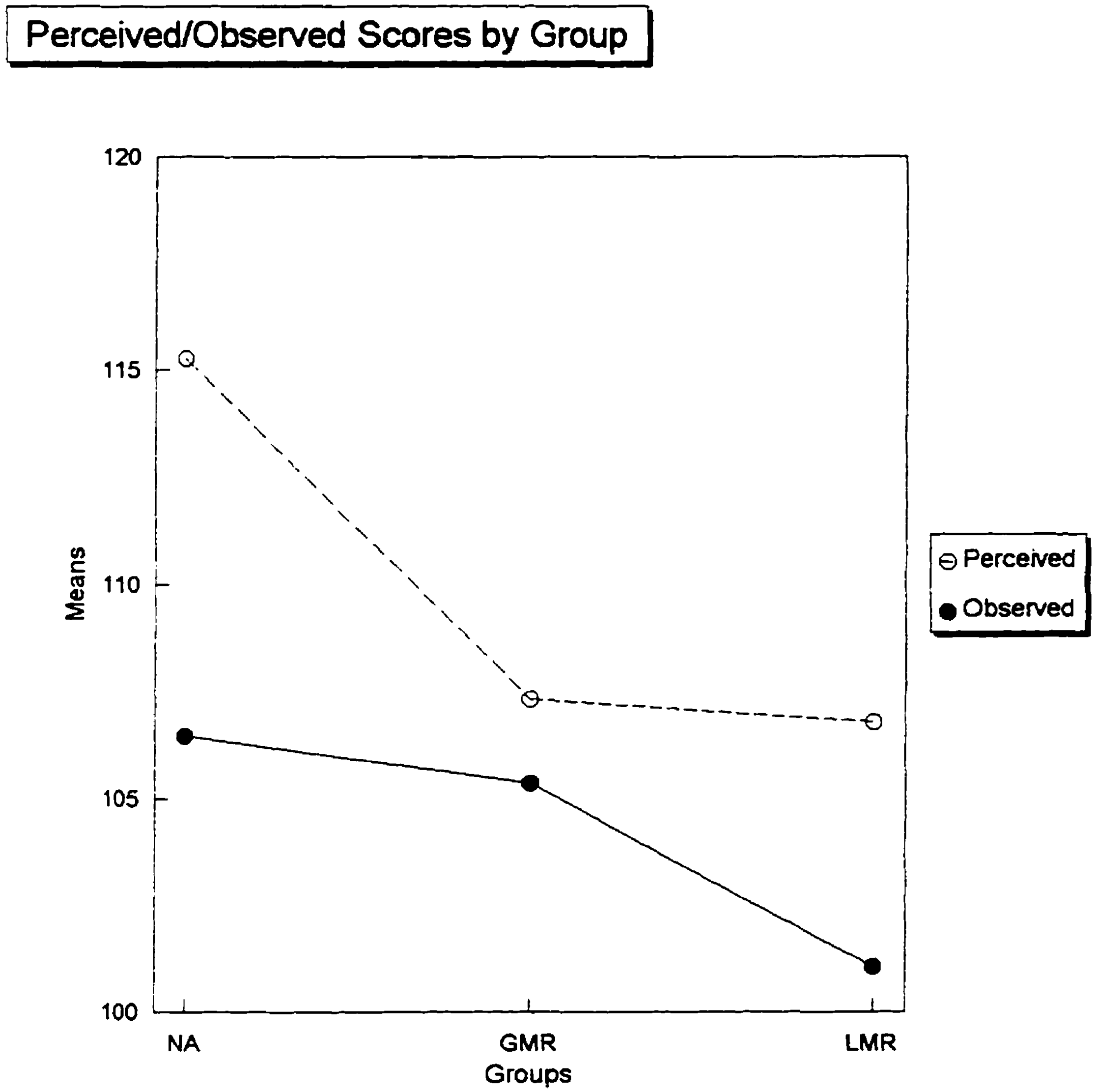

Figure 10. Means of perceived and observed scores for NA, GMR, and LMR groups based upon Reading Comprehension factor, mean WAIS-R scores.

* GMR - Reading Comprehension group greater than median
** LMR - Reading Comprehension group less than median

Arithmetic, WRAT-R Arithmetic, WRAT-R Arithmetic with an extra 10 minutes, and Arithmetic Estimation Multiplication Accuracy were the four subtests comprising this factor. The average of these four tasks for each subject in the group with LD was calculated. Subjects having averages above the median were assigned to the GMA group, and those having scores falling at or less than the median were assigned to the LMA group. Analyses were performed comparing the NA, GMA, and LMA groups.

Self-Efficacy on the WRAT-R

The three-way interaction was not significant ($F(4,258)=1.94$, $p=.10$). However, there were two significant two-way interactions: Groups by Tests ($F(4,258)=7.88$, $p=.001$), and Predicted/Observed scores by Tests ($F(2,258)=5.86$, $p=.003$). Table 16 shows the means, standard deviations, and t tests, and Figure 11 plots the means associated with the Groups by Tests interaction. Because this analysis averages predicted and observed scores it does not measure self-efficacy as such, but the findings will be discussed briefly. The NA group outperformed the GMA group in both Reading and Spelling, but no significant difference between groups in Arithmetic existed. The NA group outperformed the LMA group significantly in all three of the Reading, Spelling, and Arithmetic subtests. Finally, there was no difference in performance between the GMA and LMA groups in Reading and Spelling. However, the GMA group was significantly better than the LMA group in Arithmetic.

Table 17 and Figure 12 show that the Perceived/Observed scores by Tests interaction was due primarily to the pooled groups' tendency to overestimate in Arithmetic.

Table 16 Means, Standard Deviations, and t Tests Comparing NA Group with GMA and LMA Groups Based Upon Arithmetic Factor, WRAT-R

	NA (n=80)	GMA (n=90)	t	NA (n=80)	LMA (n=94)	t	GMA (n=90)	LMA (n=94)	t
Reading	116.90	105.96	4.58**	116.90	104.44	5.26**	105.96	104.44	0.66
	(12.84)	(13.55)			(18.12)				
Spelling	114.11	101.37	5.33**	114.11	98.71	6.51**	101.37	98.71	1.16
	(15.61)	(14.45)			(19.86)				
Arith.	109.46	107.96	-1.05	109.46	90.53	8.00**	107.96	90.53	7.60**
	(17.40)	(16.17)			(17.48)				

Note. Per = Perceived, Obs = Observed

Standard Deviations are in parentheses.

GMA - Subgroup greater than median on Arithmetic Factor

LMA - Subgroup less than or at median on Arithmetic Factor

**$p < .01$

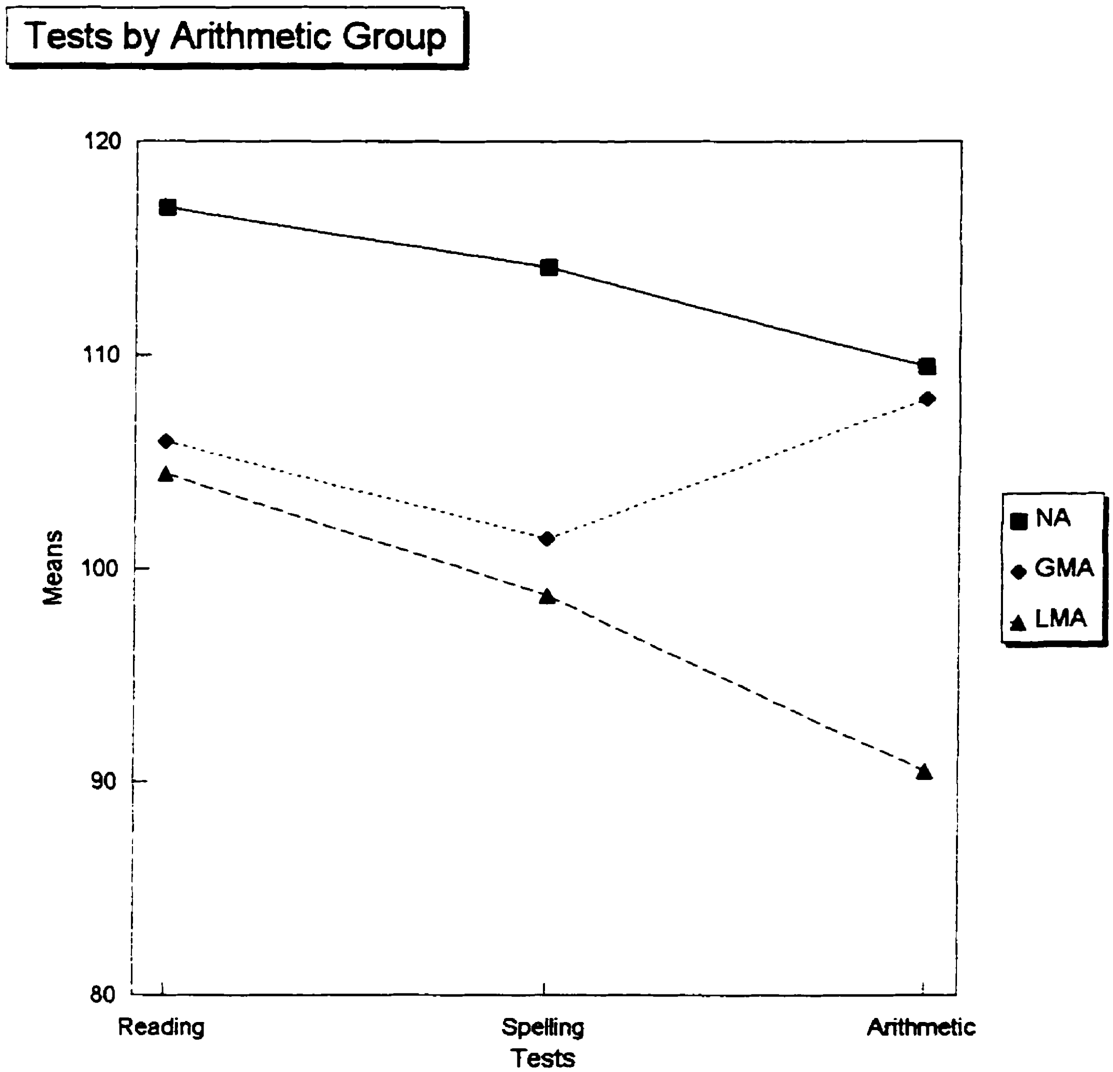

Figure 11. Means of NA group and GMA and LMA groups based upon Arithmetic factor, combined perceived and observed scores, WRAT-R.

* GMA - Arithmetic group greater than median
** LMA - Arithmetic group less than median

Table 17 Means and *t* Tests Comparing Perceived with Observed Scores for Combined NA, GMA, and LMA Groups , WRAT-R

	Perceived (n=132)	Observed (n=132)	*t*
Reading	109.15	108.31	0.65
	(19.65)	(11.41)	
Spelling	103.18	105.39	-1.70
	(21.77)	(13.09)	
Arith.	104.38	100.04	3.35**
	(21.96)	(15.44)	

Note. Per = Perceived, Obs = Observed

Standard Deviations are in parentheses.

GMA - Subgroup greater than median on Arithmetic Factor

LMA - Subgroup less than or at median on Arithmetic Factor

**$p < .01$

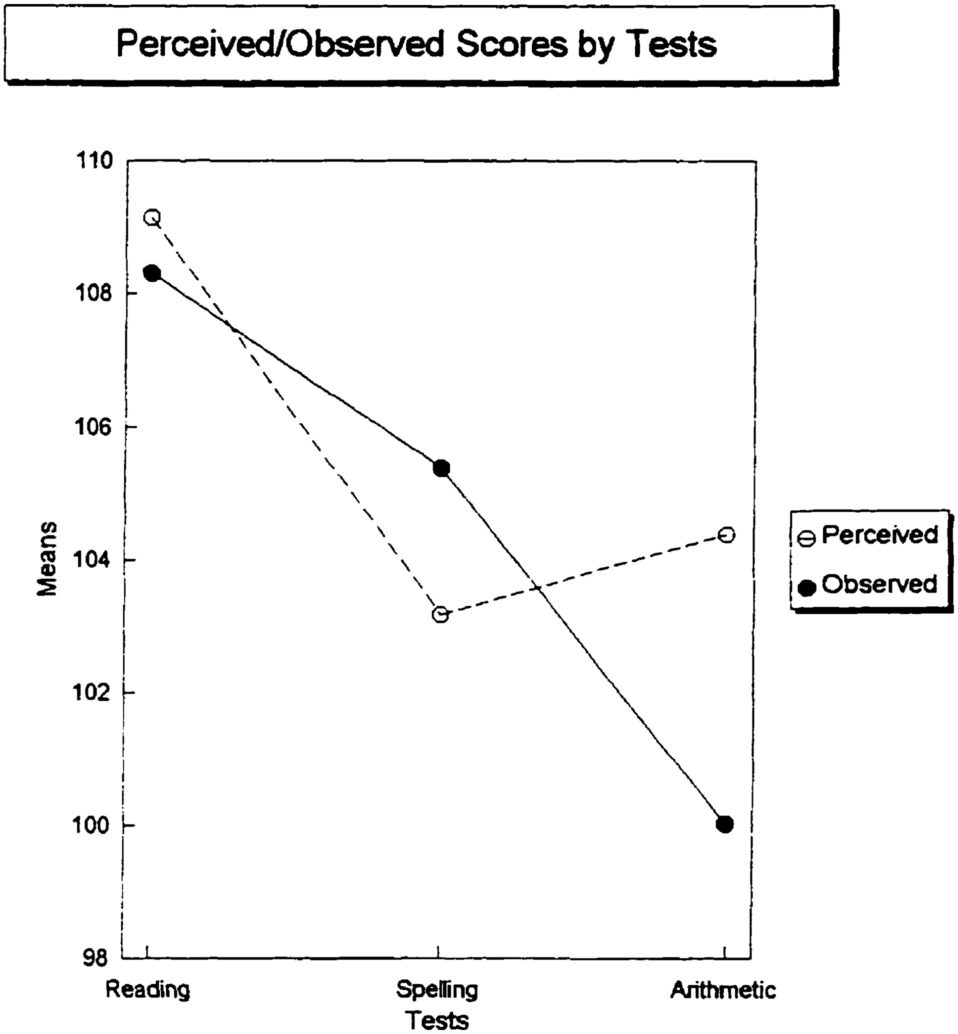

Figure 12. Means of perceived and observed scores for combined NA group and GMA and LMA groups based upon Arithmetic factor, WRAT-R.

* GMA - Arithmetic group greater than median
** LMA - Arithmetic group less than median

Self-Efficacy on the WAIS-R

The three-way interaction was significant ($F(16,1032)=2.26$, $p=.003$). Table 18 shows the means, standard deviations, and *t* tests, and Figures 13 and 14 show the predicted and observed means on the verbal and performance subtests respectively.

Self-efficacy on the verbal subtests. In Information, contrary to the hypothesis, both the GMA and LMA groups like the NA group overestimated. In Digit Span the GMA group like the NA group did not differ significantly between predicted and observed scores, whereas the LMA group significantly underestimated its performance. Although the NA group did not overestimate, the less severe GMA group had a similar pattern to the NA group and the more severe LMA group displayed lower efficacy. In the remaining three subtests, Vocabulary, Arithmetic, and Similarities, the NA group overestimated whereas in comparison the GMA and LMA groups had realistic self-efficacy. The results on these latter three subtests were consistent with the first hypothesis.

Self-Efficacy on the performance subtests. Like the NA group, the GMA and LMA groups significantly overestimated their performance in Object Assembly and Digit Symbol. On Block Design, as with the NA group, no significant differences between predicted and observed scores existed in either the GMA or LMA groups. The fact that in a nonverbal area the GMA and LMA groups displayed similar patterns to the NA group is consistent with the second hypothesis. In one minor case, the Picture Completion response pattern was different: Both the NA and GMA

Table 18 Means and t Tests Comparing Perceived with Observed Scores for NA Group and for GMA and LMA Groups Based Upon Arithmetic Factor, WAIS-R

	NA (n=40)			GMA (n=45)			LMA (n=47)		
	Per	Obs	t	Per	Obs	t	Per	Obs	t
Information	117.25 (14.98)	104.75 (10.80)	5.30**	114.11 (16.86)	106.22 (11.39)	3.55**	111.28 (20.23)	99.57 (11.97)	5.38**
Digit Span	111.75 (14.44)	111.25 (11.81)	0.21	98.22 (19.34)	101.44 (12.23)	-1.45	90.74 (16.91)	99.04 (11.45)	-3.81**
Vocabulary	117.88 (16.64)	107.75 (11.60)	4.29**	104.67 (16.25)	107.00 (09.19)	-1.05	105.43 (19.16)	105.32 (12.83)	0.05
Arithmetic	117.63 (20.41)	106.75 (10.53)	4.61**	108.44 (15.55)	106.78 (10.40)	0.75	90.43 (18.05)	93.94 (09.89)	-1.61
Similarities	113.88 (14.74)	107.75 (11.03)	2.60*	108.67 (13.87)	106.00 (09.69)	1.20	107.77 (18.62)	104.57 (12.63)	1.47
Pic. Comp.	112.13 (12.90)	99.25 (10.41)	5.46**	109.67 (15.61)	101.56 (11.77)	3.65**	105.96 (16.70)	101.06 (11.98)	2.25
Block Design	112.75 (19.45)	110.25 (11.21)	1.06	111.11 (18.64)	114.67 (16.36)	-1.60	106.28 (20.42)	105.00 (13.27)	0.59
Obj. Assembly	113.63 (13.49)	102.63 (09.87)	4.66**	113.00 (15.17)	105.78 (15.15)	3.25**	113.62 (16.83)	102.45 (15.28)	5.13**
Digit Symbol	120.63 (16.34)	107.75 (11.03)	5.46**	112.89 (17.40)	101.11 (12.47)	5.30**	115.21 (18.27)	97.13 (12.37)	8.31**

Note. Per = Perceived, Obs = Observed

Standard Deviations are in parentheses.

GMA - Subgroup greater than median on Arithmetic Factor

LMA - Subgroup less than or at median on Arithmetic Factor

* $p < .05$

** $p < .01$

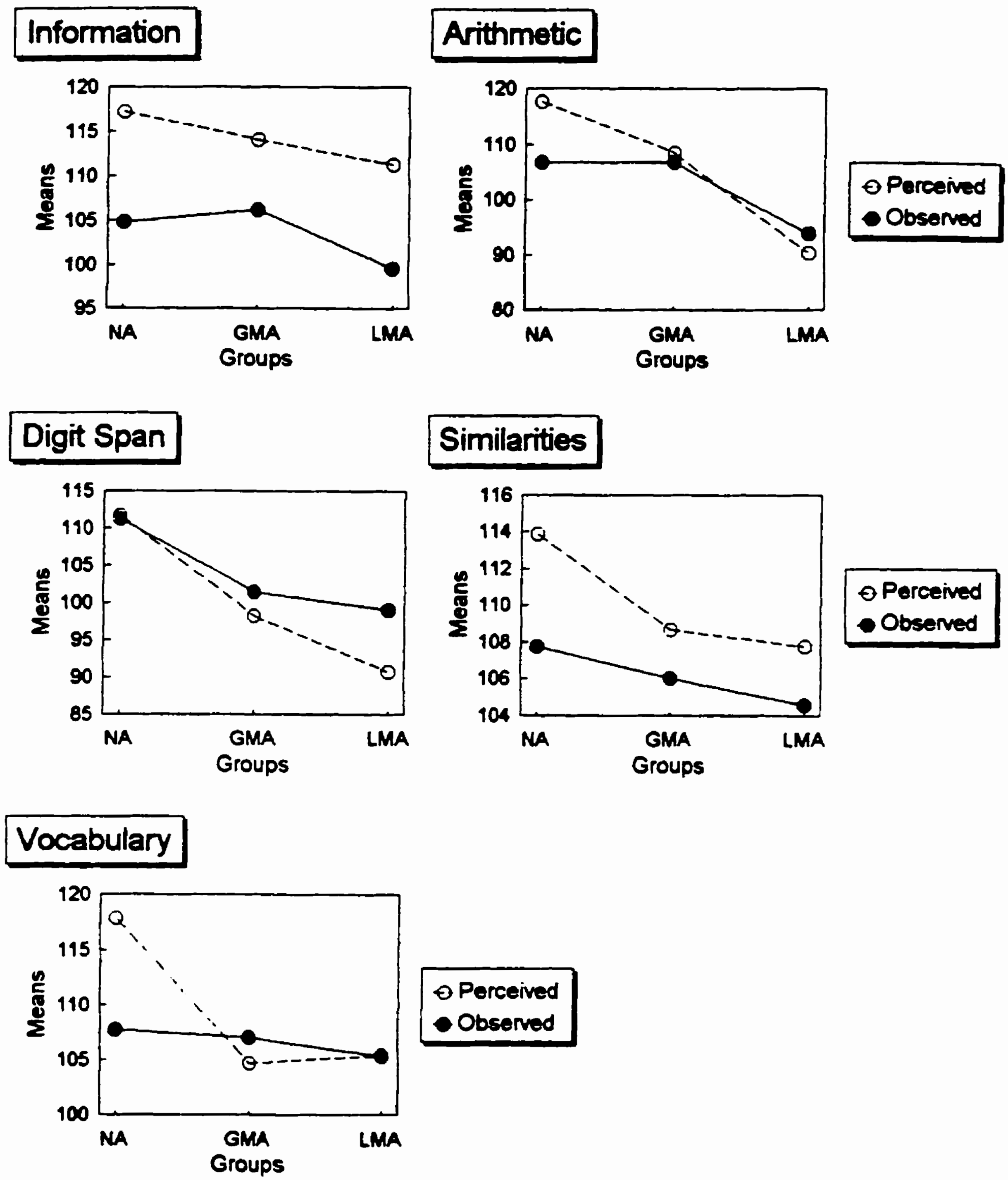

Figure 13. Means of perceived and observed scores of NA, GMA, and LMA groups, WAIS-R verbal subtests.

* GMA - Arithmetic group greater than median
** LMA - Arithmetic group less than median

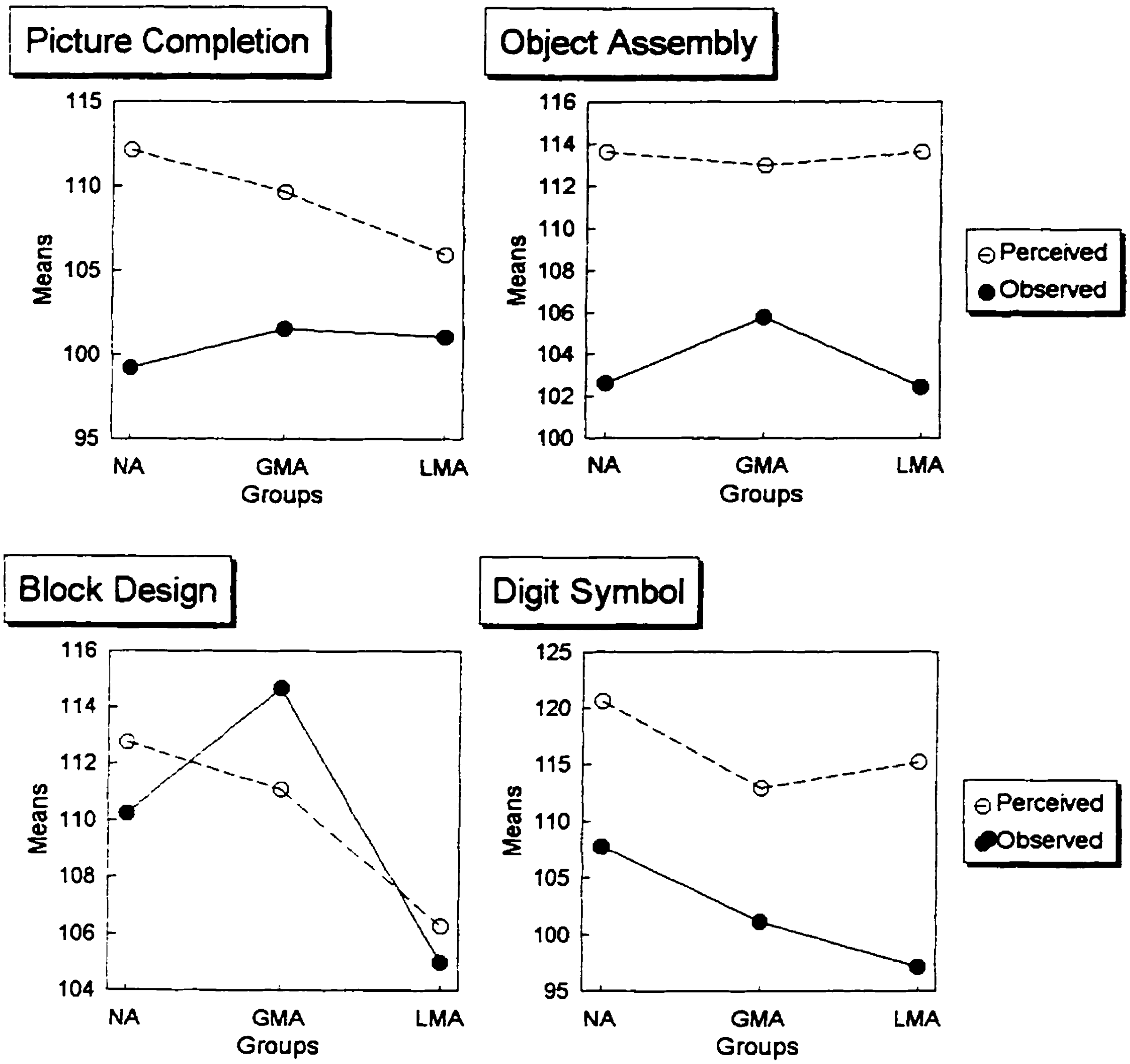

Figure 14. Means of perceived and observed scores for NA, GMA, and LMA groups, WAIS-R performance subtests.

* GMA - Arithmetic group greater than median
** LMA - Arithmetic group less than median

groups overestimated significantly, whereas the LMA group's predicted and observed scores did not differ significantly.

In the WAIS-R, the only verbal subtest in which the GMA group differed from the total group with LD was in Digit Span. In this subtest, this group, like the NA group, had an accurate appraisal whereas the more severe LMA disability group significantly underestimated.

In the performance section, the LMA group differed from the total group with LD in Picture Completion. In this subtest, the LMA group significantly underestimated, whereas the total group with LD significantly overestimated.

CHAPTER FOUR - DISCUSSION

In this study, hypotheses about the relations between predicted and observed scores of post-secondary students with and without LD were investigated. Hypotheses were derived from Bandura's (1977) theory of self-efficacy. Bandura postulated that people's past interpretations of how well they performed tasks influences their expectations of success when approaching future related tasks. He also noted that people usually tend to overestimate how well they will perform (Bandura, 1986). When measuring self-efficacy, Bandura argued that subject-specific rather than global indices should be used when comparing cognitions (efficacy estimates) and behaviours (actual performances). Bandura's self-efficacy scales were mastery-oriented, that is, people were required to provide absolute ratings of achievement.

Taylor and Brown (1988), like Bandura, asserted that most people overestimate and consequently maintain positive self-illusions. They argued that such illusions influence willingness to accept challenges whereas veridical estimates undermine achievement by reducing task-orientation, problem-solving, coping behaviour, and persistence in the face of potential failure or rejection.

Developing a conviction that they can perform tasks successfully may have positive effects on students with LD. These students have often experienced failure in school, and such experiences may have reduced beliefs in personal efficacy. Saracoglu et al. (1989) noted that despite the fact that university students with LD had overcome many obstacles, they had significantly lower levels of general self-efficacy and academic and emotional adjustment compared to NA students. The authors added that, in their clinical experience, students with LD appeared to hold negative perceptions of their abilities. Therefore, it was important to investigate how students with LD perceive themselves relative to their same-age peers.

A comparative scale of expected level of performance was used rather than an absolute rating scale. The scale indicated students' beliefs about their abilities relative to their perceptions of abilities of same-age peers. Students did not receive training in a specific subject (unlike much of Bandura's research), and so mastery scales measuring absolute ability before and after training were inappropriate.

Calibration of Competence

An important aspect of this study is dealt with in the literature on calibration, or accuracy of response. Pajares (1996a) discussed this problem with respect to the practical implications of calibration. Many educators believe that accurate beliefs about personal ability assist students to use and acknowledge appropriate cognitive strategies. In regard to this view, Pajares (1996a) stated: "How much confidence is too much confidence? I am uncertain as to when overconfidence may be characterized as excessive and maladaptive in an academic enterprise" (p. 5). He argued that accuracy of beliefs and action may not be functional in an academic context where students are challenged to exceed their present capabilities.

Calibration of competence, then, depending on the context in which adaptation occurs, is a problem that is more complex than proponents of calibration theory originally imagined.

This study also borrowed from Stanovich's (1988) phonological core variable difference model in which he distinguished the decoding level (DL) model from the comprehension level (CL) model, stating that both constructs measured different subskills. In DL studies, single word decoding tasks are used which require vertical subskills measuring domain-specific core phonological decoding skills. On the other hand, in CL studies, reading comprehension tasks require horizontal subskills (i.e., a broad range of cognitive skills) to respond to questions. In these latter studies, skills such as listening, attending to cues, and testwiseness are strategies to compensate for deficits. Therefore, scores made by people classed as reading disabled (RD) in the CL studies may have been higher than those in the DL studies due to the use of compensatory skills, and phonological coding may have only been partially measured. Stanovich concluded that it is misleading to compare DL and CL studies because these domains contain quite different subskills. He suggested instead that researchers compare groups using either the CL or the DL measures, with the understanding that each domain would produce different results.

In the present study, Principal Components Analyses were performed on a variety of achievement tests that had been administered to the students with LD. Two factors, namely

Decoding and Reading Comprehension, resembled Stanovich's (1988) DL and CL models, respectively. It was therefore decided not only to examine self-efficacy in the NA group and total group with LD but also to perform supplementary analyses examining self-efficacy in groups scoring greater than the median (GM) and groups scoring lower than or at the median (LM) within the Decoding and Reading Comprehension dimensions.

The Principal Components analyses also indicated that an Arithmetic dimension was represented in the group with LD. Because arithmetic disabilities are frequently observed in academic groups, it was also decided to perform an additional analysis examining GM and LM subgroups on the Arithmetic dimension. In all self-efficacy analyses, the contrast group of NA subjects was used when comparing perceived and observed scores on the various subtests of the WRAT-R achievement and WAIS-R aptitude tests.

Evidence for Self-Efficacy Theory

In this study, the primary interest was whether three-way interactions among groups by predicted and observed scores by subtests would occur. Table 19 summarizes differences between means of predicted and observed subtest scores among the various groups and Table 20 summarizes differences between means where there were significant two-way interactions. Based upon Bandura's theory of self-efficacy, it was hypothesized that students with LD would (a) significantly underestimate or provide realistic estimates of their relative performance in tasks related to their deficit areas, while the NA group would

Table 19 Complete Pattern of Three-Way Interactions

WRAT-R

	Decoding					Reading Comprehension			Arithmetic (Not a Significant Three-Way Interaction d; F(4,258)=1.94, p=.10)		
	NA	LD	NA	GMD	LMD	NA	GMR	LMR	NA	GMA	LMA
R	P>O	P=O	P>O	P=O	P=O	P>O	P=O	P=O	P>O	P=O	P=O
S	P=O	P<O	P=O	P=Oc	P<O	P=O	P<O	P=Ob	P=O	P<O	P=Ob
A	P=O	P>O	P=O	P=Oc	P>O	P=O	P=Oc	P>O	P=O	P=Oc	P>O

WAIS-R

	Decoding					Reading Comprehension (Not a Significant Three-Way Interaction d; F(16,1032)=1.43, p=.12)			Arithmetic		
	NA	LD	NA	GMD	LMD	NA	GMR	LMR	NA	GMA	LMA
Verbal											
I	P>O	P>O	P>O	P>O	P>O	P>O	P>O	P>O	P>O	P>O	P>O
DSp	P=O	P<O	P=O	P<O	P<O	P=O	P<O	P=Oc	P=O	P=Oc	P<O
V	P>O	P=O	P>O	P=O	P=O	P>O	P=O	P=O	P>O	P=O	P=O
A	P>O	P=O	P>O	P=O	P=O	P>O	P=O	P=O	P>O	P=O	P=O
S	P>O	P=O	P>O	P>Oc	P=O	P>O	P=O	P=O	P>O	P=O	P=O
Performance											
PC	P>O	P>O	P>O	P>O	P>O	P>O	P=Oa	P>O	P>O	P>O	P=O
B	P=O	P=O	P=O	P=O	P=O	P=O	P=O	P=O	P=O	P=O	P=O
OA	P>O	P>O	P>O	P>O	P>O	P>O	P>O	P>O	P>O	P>O	P>O
DSy	P>O	P>O	P>O	P>O	P>O	P>O	P>O	P>O	P>O	P>O	P>O

Bolded Sets for Each Subtest Indicate Support for Hypotheses

P>O indicates Perceived>Observed score
P=O indicates Perceived=Observed score
P<O indicates Perceived<Observed score

a GMR pattern differed from total LD pattern and NA pattern
b LM pattern differed from total LD pattern and resembled NA pattern
c GM pattern differed from total LD pattern and resembled NA pattern
d There were no significant three-way interactions for the Arithmetic factor WRAT-R nor for the Reading Comprehension factor WAIS-R

GMD greater than median on decoding factor, LMD less than or at median on decoding factor
GMR greater than median on reading comprehension factor, LMR less than or at median on reading comprehension factor
GMA greater than median on arithmetic factor, GMA less than or at median on arithmetic factor

Table 20 Patterns of 2-Way Interactions for WRAT-R Arithmetic Groups and WAIS-R Reading Comprehension Groups

WRAT-R	Tests x Group Interaction Arithmetic			Pred/Obs Scores x Tests Interaction Arithmetic
	NA vs GMA	NA vs LMA	GMA vs LMA	Tests
R	NA>GMA	NA>LMA	GMA=LMA	P=O
S	NA>GMA	NA>LMA	GMA=LMA	P=O
A	NA=GMA	NA>LMA	GMA>LMA	P>O

WAIS-R Verbal	Tests x Group Interaction Reading Comprehension			Pred/Obs Scores x Tests Interaction Reading Comprehension		Pred/Obs x Group Interaction Reading Comprehension		
	NA vs GMR	NA vs LMR	GMR vs LMR	Tests		NA	GMR	LMR
I	NA=GMR	NA>LMR	GMR>LMR	P>O	Scores	P>O	P=O	P>O
DSp	NA>GMR	NA>LMR	GMR=LMR	P<O				
V	NA=GMR	NA>LMR	GMR>LMR	P=O				
A	NA>GMR	NA>LMR	GMR=LMR	P=O				
S	NA=GMR	NA>LMR	GMR=LMR	P>O				
Performance								
PC	NA=GMR	NA=LMR	GMR=LMR	P>O				
B	NA=GMR	NA=LMR	GMR=LMR	P=O				
OA	NA=GMR	NA=LMR	GMR=LMR	P>O				
DSy	NA>GMR	NA>LMR	GMR=LMR	P>O				

P>O indicates Perceived>Observed score
P=O indicates Perceived=Observed score
P<O indicates Perceived<Observed score

NA =GMR or G MA - NA group is not significant different than Greater than Median Reading Comprehensionsion or Arithmetic Factors
NA > GMR or GMA - NA group is significantly different in the positive direction than Greater than Median Reading Comprehension or Arithmetic Factors
NA < GMR or GMA - NA group is significantly different in the negative direction than Greater than Median Reading Comprehension or Arithmetic Factors
NA =, >, < LMR or LMA - same as above, however, in this case the NA group's scores are compared with the Lower than or at the Median Reading Comprehension or Arithmetic Factors

tend to overestimate; and (b) the pattern of response in the group with LD would tend to resemble the NA group in tasks not directly related to their deficit area. Self-efficacy research with tertiary-level students with LD has not been done extensively, and so significance tests were non-directional. Examining the pattern of relations in Table 19 indicates that although there are some inconsistencies, the preponderance of evidence appears to suggest that self-efficacy theory permits useful inferences.

Self-Efficacy in NA Group and Total Group with LD

It had been predicted that the NA group would tend to overestimate across tests relative to the group with LD. Table 19 showed that the NA group had realistic estimates on two out of three subtests (Spelling and Arithmetic) of the WRAT-R and on two out of nine subtests (Digit Span and Block Design) on the WAIS-R; however, they overestimated significantly on all other subtests. They did not underestimate significantly in any subtests. Possible reasons for these findings will be discussed later.

Of particular interest was the comparison of patterns of self-efficacy between groups on the WRAT-R. In Reading, the NA group overestimated, but the group with LD did not overestimate. In Spelling, the NA group did not overestimate, but the group with LD displayed quite low self-efficacy by significantly underestimating. The pattern in Arithmetic was directly contrary to the hypotheses with the NA group having realistic estimates of ability but with the group with LD overestimating significantly.

Table 19 showed that on the verbal subtests of the WAIS-R, the NA group overestimated in four of the five subtests. The group with LD did not overestimate in four of the five subtests. In Digit Span the NA group did not overestimate, whereas the group with LD underestimated significantly. Both the NA group and the group with LD overestimated in Information. This finding will be discussed later.

The performance subtests of the WAIS-R are not as obviously dependent upon verbal skills as the verbal subtests. It was therefore expected that members of the group with LD would display patterns of estimation resembling the NA group. As expected, the self-efficacy patterns of these two groups were comparable. In three out of four subtests, both groups overestimated. In Block Design, both groups had realistic expectations of achievement.

Deviations from hypotheses

Information. Although many of the patterns of self-efficacy for the NA group and for the total group with LD were consistent with Bandura's theory, there were some incompatible cases. The first inconsistency was in the Information subtest where both groups significantly overestimated. This was a verbal test, and the group with LD was not expected to overestimate. A possible explanation for this unexpected finding on Information was a calibration problem in the more difficult example given in the instructions for self-estimates. The comparable question "Who invented the airplane?" was answered correctly by over sixty percent of subjects in an item difficulty analysis in the WAIS (Matarazzo, 1972). Assuming that contemporary students are equally familiar with the Wright brothers or John Langley (either answer is accepted as a correct response), this example may have given a misleading impression that the subtest was not very difficult. If most students find this example easy to answer, a large proportion might overestimate in the test.

Another possible reason for this finding is that a population of post-secondary students may believe that they are more knowledgable than other people their age.

Picture completion. The LMA group had an accurate estimation of ability, whereas both the GMA and NA groups, as expected, overestimated significantly. A possible interpretation for this finding may be related to speed of response. Students are told that they must find a certain small detail, and are shown the example items briefly. If they possess an inadequate knowledge base, or if they have difficulty with attention or are impulsive, they may believe that their task performance will be affected, and so they may tend to have veridical estimation. However, this was the only case in which there was veridical estimation in the Picture Completion subtest.

Spelling. Neither the NA group nor the group with LD overestimated on the Spelling task. Spelling is a highly observable behaviour. Also, it is highly automatized; you either know how to spell 'cat' or you do not. In school, students receive considerable feedback about their spelling achievement through corrected essays and by spelling tests. Modern computers with spell check routines deliver feedback about writers' skill or lack of skill in this area. The NA group and the group with LD probably have developed fairly realistic impressions of their relative spelling ability. One NA student reported after testing that he had allowed his spelling skills to slip. (He used spell-check when deciding whether his spelling was correct). Depending either on machines for spelling or not placing great value on the task (professors may not emphasize the need for perfect spelling to pass courses) may have affected the students' estimates.

Arithmetic. The lack of overestimation by the NA group in the WRAT-R Arithmetic test but overestimation by the group with LD was unexpected. The realistic estimation of the NA group may be related to the fact that the majority of the group was in social studies and humanities. It is likely that most of the students placed greater value on analyzing and comprehending narrative and expository text, developing coherent outlines, writing logical essays and reports, and becoming test-wise rather than maintaining skills in functions and relations, algebra, and calculus. After testing, a number of NA students reported that they could not remember procedures for solving the more advanced arithmetic questions because they had not performed such sophisticated operations since high school. It should be noted that in the consumer-oriented Arithmetic test of the WAIS-R (presented prior to the WRAT-R Arithmetic task), they felt more efficacious and overestimated.

The significant overestimation on the WRAT-R Arithmetic test by the group with LD is related to its relatively weak observed score. The predicted mean of 101.51 indicated that they expected to give an average performance as compared to their same-age mates. Their obtained mean was 96.72. The reason for this overestimation may be related to inability to understand the complexities of the task after seeing the example. Bandura and Schunk (1981) and Schunk (1996) reported that students who were failing arithmetic often overestimated. When shown examples of advanced subtraction and fraction questions requiring subtle mathematical operations, these students apparently did not recognize the sophisticated operations required to obtain a solution, and so they interpreted the problem as being simpler than it actually was. For example, Schunk (1996) stated: "...problems such as **1/2 + 1/4** look deceptively easy to the uninitiated, who might add numerators and denominators (**2/6**). Perceived low task difficulty leads to overconfidence" (p. 18). Students with LD may not have understood the complexity of factoring ($3X^2 - 36X = 162$) and therefore overestimated.

__Digit Span and Block Design.__ Perceived and observed scores of the NA group on Digit Span and Block Design were not significantly different. The responses to these tasks are observably right or wrong. Either the digits match or do not match, and either the pattern on the surface of the blocks matches the figure or it does not. It is possible that the observable nature of the scoring criteria provided students with cues about the difficulty of the test.

The significant underestimation in Digit Span by the group with LD was interesting. The subtest is considered a measure of distractibility, attention span, working memory, rote memory, reversibility, and concentration (Kaufman, 1990). Apparently the group with LD was so sensitive to its deficiencies in this area that it significantly underestimated its performance.

Supplementary Analyses

To explore further the self-efficacy patterns within the group with LD, it was split into greater than median (GM) and less than or at median (LM) subgroups using the Decoding, Reading Comprehension, and Arithmetic factor scores. These refined analyses were intended to explore in more depth the estimation patterns of the NA group and entire group with LD. Of particular interest were the overall estimation patterns of the factor groups to determine whether the groupings were similar to the preliminary analysis using the NA group and total group with LD.

Self-efficacy of GMD and LMD groups based upon Decoding. Table 19 shows that in both the WRAT-R and the WAIS-R, the self-efficacy patterns of the LMD group were identical to those in the total group with LD. In three cases, the GMD group differed from the total group with LD. As might be expected, in these three cases the GMD group's patterns resembled those of the NA group. These three cases were

Spelling and Arithmetic in the WRAT-R and Similarities in the WAIS-R. In the performance subtests of the WAIS-R, the self-efficacy patterns of the NA, GMD, and LMD groups were similar.

As stated before, the results of the estimation patterns in the three groups were more complex than expected in the preliminary hypothesis. It could be argued that the LMD group had higher self-efficacy in arithmetic-related tasks because arithmetic was not its specific deficit area. Possibly the NA group only had strong self-efficacy in Reading and not in Spelling and Arithmetic because there was not much personal investment in these latter tasks.

Self-efficacy of GMR and LMR groups based on Reading Comprehension. Table 19 shows that a significant three-way interaction only occurred on the WRAT-R. Here the LMR group did not underestimate its performance in Spelling, unlike the total group with LD that did underestimate its performance. In this respect, the LMR group resembled the NA group, having realistic estimates of performance. In Arithmetic, the GMR group, unlike the total group with LD, had realistic estimates. In this case the GMR pattern was similar to that of the NA group.

In its lack of three-way interaction and in the LMR group's realistic estimates, the Reading Comprehension group had a different pattern than the total group with LD or the Decoding group. Stanovich (1988) argues that the reading comprehension dimension is related to rather broad cognitive capabilities. Perhaps the results using the Reading Comprehension factor, which resembled the reading comprehension dimension Stanovich referred to, may be more diffuse than in the previous two analyses because the level of performance in this dimension was based upon broader intellectual capabilities that do not reflect a well-focused deficit (i.e., it did not reflect a core phonological deficit).

Although in the WAIS-R, there was not a significant three-way interaction, it was suggested that Bonferroni *t* tests be conducted to compare predicted and observed scores for each group on each subtest to determine whether in the Reading Comprehension group similar trends occurred as in the other supplementary analyses. Table 19 shows that in only two comparisons, Digit Span and Picture Completion, was there a pattern different than that observed in the initial analysis. In Digit Span, the LMR group, like the NA group (which had veridical estimation) displayed accurate estimations, and in Picture Completion, the GMR group, unlike the NA or the LMR groups (which overestimated) displayed veridical estimation. Although the three-way interaction was not significant, the patterns of differences between perceived and observed scores, on the whole, do not depart substantially from those in the other supplementary analyses, and so they provide some support for the hypotheses.

Self-efficacy of GMA and LMA groups based upon Arithmetic. There was no three-way interaction on the WRAT-R. On the WAIS-R the self-efficacy patterns of the GMA and LMA groups were similar to those of the total group with LD except in two cases. First, in the Digit Span subtest, the GMA group, like the NA group, displayed realistic self-efficacy. The LMA group, like the total group with LD, significantly underestimated its performance in Digit Span.

Second, in Picture Completion, the LMA group had accurate estimates of ability, whereas the NA and GMA groups significantly overestimated, as was seen in the initial analysis and in the decoding factor.

Although in the WRAT-R, there was not a significant three-way interaction, it was suggested that Bonferroni t tests be conducted to compare predicted and observed scores for each subtest to determine whether in the Arithmetic group similar trends occurred as in the other supplementary analyses. Table 19 shows that the pattern of differences between predicted and observed scores in this analysis was identical to that in the Reading Comprehension group. Although the three-way interaction was not significant, the patterns of differences between perceived and observed scores, on the whole, do not depart substantially from those in the other supplementary analyses, and so they provide some support for the hypotheses.

Table 20 summarizes the patterns of differences between means in the significant two-way interactions. In the supplementary analysis using the Arithmetic factor scores on the WRAT-R there was a Group by Tests and a Predicted/Observed Scores by Tests interaction. In the supplementary analysis using the Reading Comprehension factor scores on the WAIS-R there was a Group by Tests, a Predicted/Observed Scores by Tests, and a Group by Predicted/Observed Scores interaction.

Implications of the Study

The issue of subtyping. It was originally intended to subdivide the group with LD using a single level of disability scale. However, when relations among the various diagnostic tests were examined, it became apparent that a single disability scale would not represent the complexity of the data. The analysis suggested that a complex factorial structure existed with three factors: Decoding, Reading Comprehension, and Arithmetic being of particular theoretical interest. Each of these factors had substantial loadings from four or more subtests belonging to three separate tests. This finding indicated that the domain sampled had reasonable generality. An additional observation is that the factor scores contained subtests from locally-developed tests as well as commercial tests.

Although a variety of approaches have been suggested for subtyping children and adults with LD, the present one was adopted because it fit the data so well. One example of other ways of subtyping is that suggested by Siegel and Heaven (1986). Their approach was based upon the Reading and Arithmetic subtests of the WRAT-R, although IQ cut-offs were also used. In addition, parent/teacher questionnaires were employed. Subjects are subtyped into Reading Disabled, Arithmetic Disabled, or Reading Arithmetic Disabled depending on whether they score (a) above or (b) at or below the 25th percentile or the 30th percentile on various combinations of the WRAT-R Reading and Arithmetic subtests. Such approaches may give useful diagnostic information, but they present difficulties for theoretical studies. First, single subtests are used as indices of Reading and Arithmetic, but psychometrists suggest that a better strategy is to sample a particular domain by multiple tests (Hughes et al., 1990). Second, the subtyping procedure adopted by Siegel and Heaven (1986) is more commonly used with children: few post-secondary students with LD would score below the cut-off points, particularly in Reading.

Possible modifications of the self-estimate test. A major deficiency in the self-estimate test may be the difficult example in Information. If the question about the Wright Brothers appears to respondents to be a relatively easy question, both NA students and students with LD would be misled about the subtest's difficulty and provide an invalid estimate of their performance.

Another possible modification is to administer the self-estimate test immediately before the WAIS-R and the WRAT-R. This practice is now followed in the clinic. If the self-estimates are given immediately before the tests, the concern that subjects might research answers to items in the unsupervised period between test sessions would be alleviated. In the present self-estimate test, examples paralleling items in four WAIS-R subtests and one WRAT-R subtest are used, whereas in all other cases the examples are taken directly from the subtests. There is no empirical information about whether these parallel items really are equivalent. If predictions are given immediately before the tests, all examples could be taken from the subtests because there would be no time to research questions or to reflect upon possible answers. An important tenet of self-efficacy theory is that the estimate should be given just before the actual performance or behaviour, preferably on the same day (Bandura, 1986), and so the current testing practice in the clinic complies with this requirement.

A possible addition to the test procedure might be considered. After administering the WAIS-R and WRAT-R, subjects might provide another set of ratings of their performance. This procedure would permit both a comparison of pre- and post-estimates of ability. In the session after testing, although some students noted in hindsight that they would have changed their estimates, others stated that they would not have changed theirs.

Implications for Teaching and Counselling

Bandura and Schunk (1981) argue that in order to realize their capabilities students must possess robust beliefs in themselves. The aim of both counselling and teaching is to guide client and student growth, and Bandura's theory emphasizes that in both areas enhancing self-efficacy must not be separated from the development of skills. Bandura and others suggest that moderate overestimation of ability is desirable in motivating performance. The present study indicated that students with LD do not overestimate their academic efficacy, and it was hypothesized that the outcome of prolonged school difficulty may have played an important role in preventing them from developing overestimation of ability in academic areas.

Schunk (1989) has argued that if students are given difficult tasks that decrease the probability of achieving success experiences and if they also observe and compare themselves with other students who are having less difficulty, it is unlikely that they will develop durable self-efficacy. The modern school with its age-grading, relatively open evaluative procedures, and lock-step progression provides a situation that may prevent ideal levels of self-efficacy. Second, this stance might lead to discouragement and avoidance even of situations where the learner has the potential to be successful. Indeed, even students without LD, if continually confronted with challenges that they can not meet are apt to be severely discouraged (Bandura, 1986).

The instructional problem presented by students with LD is to develop programs where there are optimal levels of success and where students focus on their increasing skills rather than on how they compare to others. This approach requires a degree of individualization of instruction which is difficult to achieve in group teaching situations. Bandura's cognitive behavioral theory of learning provides a particularly useful framework for planning programs with students who have LD because the same principles are applicable to modifying both self-efficacy and academic skills. Direct experience, vicarious experience, persuasion, and affect are the major avenues for change.

Direct experience. Bandura (1986) argues that if people have not developed adequate self-efficacy, the most effective treatment is experiencing success. Early clinical work assisting snake phobics (Bandura, 1977) prompted him to develop the theory of self-efficacy. He designed a modeling treatment using experts (people who worked with snakes). Experts modeled specific behaviors that the clients feared, and the clients were then encouraged to copy these behaviors. Bandura gradually increased the difficulty levels of the experience (standing in the same room with a snake, poking the snake with a stick, touching a snake). Using this approach, the final experience involved direct contact with the feared object(s).

These experiences increased mastery level and further increased the predictability of the situation such that fear was neutralized. During clinical treatment, clients underwent significant changes in their beliefs. In Evans (1989), Bandura explains that he received letters from these people reporting that they overcame other fears in their lives because they realized that such fears could be controlled by using similar procedures. Mediating beliefs in their ability prior to behavior was named self-efficacy.

Counselling procedures. Self-efficacy has important implications for counselling. Counselling techniques such as group work and role-playing encourage learning from models. Next, homework assignments that are graduated in difficulty are used to maximize success. Other strategies, such as keeping detailed logs of accomplishments, cognitions, and affect, may also be employed. Clients discuss these events during sessions and redefine behaviors while counsellors provide direction and positive reinforcement.

Students with LD are expected to benefit from counselling strategies directed at enhancing mastery. Traditionally, counsellors dealt with clients' beliefs of efficacy and their related emotions. Comprehensive counselling programs involve increasing client self-efficacy as well as developing effective social skills.

Cognitive behavior theory stresses identification of sources maintaining lowered self-efficacy and developing treatments to modify them. Bandura reports that men recovering from heart attacks (see Evans, 1989) often have low self-efficacy about exercise, and it was decided that this problem partly stemmed from their wives' anxiety that such exertion might induce cardiac arrest. Three treatments were compared: (a) a doctor told wives that exercise was beneficial, (b) wives observed their husbands exercising on a treadmill machine, and (c) wives also exercised on the treadmill. Only in the third treatment, where the wives experienced the strenuous exercise that their husbands performed weekly in physiotherapy did their belief in their husbands' abilities change.

One problem with counselling students having LD is analogous to that of wives with husbands recovering from heart attacks. Parents and/or spouses often want to protect them from failure associated with attempting new behaviours, thereby reducing self-efficacy in students that is counterproductive to therapy. In these cases, counsellors must assist both clients and family members to recognize the genuine success that has been achieved by students and the strengths and potential that they possess so that they will not be overprotected. Often, also, family members become so focused upon possible failure that they overlook or dismiss successes.

Some learners avoid situations in which they have the capability to succeed. Others have become so sensitive to personal shortcomings that they overlook or belittle their success. Although the students with LD in this study gained admission to tertiary education, in the area of verbal aptitude they did not display the same degree of overestimation as the NA group. Schunk (1989) argues that teacher knowledge of learners' efficacy regarding the subjects being taught is helpful. If students do not believe that they have the ability to learn subjects, then the difficulty level of the task should be adjusted to facilitate success. Adjusting the level of challenge may be necessary to encourage reasonable, honest, successful effort.

Vicarious experiences. Using same-age students to model tasks may assist learning and encourage student efficacy (Schunk, 1989). Observing how a task is performed rather than having to read or to listen to instructions may be more informative than oral or written instruction. Further, there must be no punishment for models if they fail, or the observers' level of efficacy will decrease.

Directed instruction. Students with LD often require much more careful guidance and clear direction than NA students who can usually infer task requirements from cursory or vague remarks. Direct instruction involves a coherent discussion of expectations and recommends a variety of instructional approaches for students who have difficulty with particular modes of instruction (Schunk, 1989). Explicit, clear instructions that correspond directly to the criterial tasks is crucial (Pajares, 1994). One school practice that is anxiety-arousing for students with LD is that frequently there is only one 'right' strategy to solve a task. Educators may insist on one way to solve problems even though alternate approaches may be more effective for students with LD (e.g., taped texts, modified exams, more time on projects). As a result, students may be forced to memorize algorithms or procedures simply to pass the course. The danger of this approach is that students (a) will conclude that rote methods are the only way to learn and (b) will lack a conceptual foundation upon which to build more complex ideas.

Setting proximal goals rather than distal goals is a promising strategy (Bandura & Schunk, 1981; Schunk, 1985, 1989). Students are given a clear time line, monitor their work, and chart their goals and progress using a poster board with markers or stickers. If students feel overwhelmed or discouraged, they can review their record so that they are reminded of their achievements. This procedure works equally well for post-secondary students with LD and is particularly advisable in short-term, semestered courses.

Gender. Pajares (1994) has discussed the importance of self-efficacy for mathematics- and science-related pursuits. His findings indicate that in algebra, post-secondary women tend to have lower levels of efficacy than their male counterparts, even though they are just as skilled as men. Such beliefs may in part limit women's educational and vocational opportunities. In this study, however, gender did not affect the three-way interactions in either the WRAT-R or the WAIS-R subtests.[3]

Limitations of the Study

Although the results of this study provided support for self-efficacy theory, a number of findings indicated that the situational variables were more complex than suggested in the original statement of hypotheses. In both groups the variance for the predicted scores tended to be larger than that of the observed scores. This condition should be considered when interpreting the differences between predicted and observed means.[4]

The results on the Information subtest were interpreted as indicating that calibration of examples is important. Examples must not give an erroneous impression of task difficulty. Similarly, in the WRAT-R Arithmetic subtest, it was suggested that the total group with LD might not have had the capacity to recognize the difficulty of the example and so overestimated its performance.

An examination of subtests where the NA group did not overestimate is interesting. In both the WRAT-R Spelling and Arithmetic subtests, the NA group had realistic self-efficacy estimates. In both cases, responses are overt, and there were objective measures of accuracy directly related to the criterial task. Students have considerable opportunity to discover their relative performance in these tasks. Reading, however, which is mainly a covert behaviour, provides far less opportunity to judge relative performance, and in this subtest the NA students overestimated.

Students with LD may have been subjected to frequent assessment and may therefore have a more realistic awareness of their strengths and weaknesses than NA students. A past history of frequent assessment may therefore explain the more realistic estimates observed in the students with LD.

In the WAIS-R Digit Span and Block Design subtests, the NA group gave realistic predictions. As stated previously, it is possible that the nature of these subtests does not permit illusion about how well one will perform. Another possibility in the Digit Span subtest is that, like the group with LD, NA students may be sensitive to their limitations in short-term memory. This interpretation is related to the suggestion that the tendency to underestimate on this test by the total group with LD is due to the group's sensitivity to deficits in short-term memory. (Table 3 shows that many students with LD reported that their core problem was related to difficulties with memory: concentration, organization, and time management.) Hogarth (1987) states that it is common for people to lack confidence in their memory capacity.

Although the present study had limitations, there was substantial support for self-efficacy theory, particularly in view of the fact that the subtests of the WRAT-R and WAIS-R had not been designed originally to test the theory. There was considerable evidence that the NA group tends to overestimate achievement in WAIS-R verbal areas but that the group with LD is less likely to overestimate. There was also support for the prediction that in performance areas, which would probably not be perceived by the group with LD to be obviously related to their deficit area, the group with LD displays similar self-efficacy patterns as the NA group. It was suggested that, in part, inconsistencies with these hypotheses may have been due to problems in the calibration of examples, to the clarity of the criteria of response accuracy, and to the amount of experience in how one's performance compares to that of others'.

The problem of what is a reasonable overestimation and what is an unreasonable overestimation is a question deserving further investigation. It is possible that NA students do not, as Bandura (1986) implies, tend to overestimate generally. Indeed, in this study, on a number of subtests NA students did not overestimate. Perhaps in these subtests where NA students do not overestimate it is desirable for students with LD to have veridical estimates. Some tentative suggestions were offered about characteristics of subtests in which NA students do not tend to overestimate, but this is an early study and further studies would be required to identify tasks in which NA students tend to give veridical estimates and tasks in which they tend to overestimate.

As noted, Pajares (1996a) is concerned that we do not reduce adaptive overestimation. Hattie (1996), Schunk (1996), and Pajares (1996a) have suggested that it may be advisable to examine the relation between self-efficacy and other self theories. This type of research would not only inform researchers interested in how self theories apply to learning disabilities, it would also sensitize practitioners to the importance of adopting remedial procedures that do not reduce students' levels of self-efficacy and optimism.

Bandura (1978) states that "self-efficacy is regarded as an influential, though obviously not the sole determinant of behavior" (p. 237). He also notes that the theory is primarily concerned with beliefs about specific personal capabilities. It is therefore limited to precisely defined adaptive behaviors. The theoretical constructs of self-efficacy theory provide useful principles for modifying the very important but restricted areas of beliefs about skills and of skill learning. Self-efficacy theory was not intended to explain such broad constructs as self-concept and self-esteem. Indeed, the personal motivations and social influences that led these students with LD to aspire to tertiary level education in spite of their scholastic disabilities are the province of other theories. Bandura (1986) clearly distinguishes between self-concept, self-esteem, and self-efficacy, noting that the theories apply to and measure different phenomena. Each of these self theories "contribute in their own way to the quality of human life" (Bandura, 1986, p. 410), however, they are very different constructs.

Future Avenues for Research and Practice

As noted in the last section, self-efficacy is intended to measure people's beliefs about their capabilities of performing specific skills. Inclusion of self-concept and self-esteem measures in research and assessment would provide further information regarding personality and environmental variables such as attitude, persistence, motivation, anxiety level, and perceived parental and social expectations. Such assessment procedures would provide a more complete picture of students and how they view their environment than self-efficacy theory was designed to provide.

One extension of the Shafrir Assessment Procedure might be a self-efficacy scale for learning. Schunk (1989) distinguishes between self-efficacy for performance and self-efficacy for learning. The Sharfir Assessment Procedure, by describing achievement and aptitude tests and then asking subjects to predict how accurately they can answer them, is determining self-efficacy for performance. By self-efficacy for learning, Schunk refers to subjects' predictions of how well they will be able to acquire the skills necessary to execute particular tasks (e.g., how well they will be able to learn to perform subtraction with regrouping after they have observed a model learning to solve such problems on videotape). Students' judgments about their capabilities to acquire the skills necessary to master new tasks may give important information about their motivation and optimism in accepting challenges requiring them to learn how to adapt in unfamiliar situations.

It would be necessary to have a procedure in which students learn a specific skill in order to compare their beliefs about how well they will be able to learn with their actual acquisition (Schunk, 1996).

In this study, accurate estimation and underestimation were both treated as being equivalent contrasts to overestimation. Further research might investigate whether significant underestimation is a more inhibiting condition than veridical estimation. In two subtests, Spelling and Digit Span, where the NA group tended to have veridical estimates, the group with LD tended to underestimate significantly. In suggesting that this pattern was in the direction predicted, it was assumed that underestimation could be considered to be a more serious problem than veridical estimation.

Parent/Spouse Assessment. An extension of this study is based upon self/other theory. Perceptions held by significant others are viewed as important to understanding students' learning disabilities. The Shafrir Procedure might be extended to measure the beliefs held by significant others about the abilities of students being assessed. Their efficacy beliefs regarding the students' abilities could provide clinicians and researchers with important information about how such perceptions may affect the students' self-efficacy beliefs and may therefore be taken into consideration in planning remedial program.

Reference groups. Specifying the reference group for students prior to obtaining their predicted ratings may also provide valuable information. Two sets of measures might be obtained. Rather than estimating how well they would do as "compared to people their own age", they might be asked to estimate how well they would do as "compared to post-secondary students with LD" and as "compared to post-secondary students without LD". Identifying the reference group might provide useful information about how students with LD perceive themselves relative to different defined groups.

Process counselling. An important implication for process counselling would be to determine pre- and post-measures of self-efficacy and skill of students with LD in remediation programs. Counselling sessions dealing with feelings could be undertaken in conjunction with mastery-oriented treatment. Immediately after each session, clients and counsellors could answer the question (either verbally or in written form) "What was the **most important** event that occurred during the session?" Students displaying marked increases in self-efficacy could be compared with those who showed little change in order to determine factors associated with greater change (e.g., working alliance with the counsellor, relative direction of self-esteem and self-concept, skill level, and so forth). Pajares (1994) asserts that self-efficacy research has great potential, particularly in counselling and remediation contexts in post-secondary school (Pajares, 1994).

Pajares (in press) reports that "Accurate self-perceptions may enable students to more accurately assess their problem-solving strategies, but the danger of 'realistic' self-appraisals is that they may be purchased at the cost of lower optimism and lower levels of self-efficacy's primary functions--effort, persistence, and perseverance" (pp. 17-18). In the present study, there was a tendency for students with LD to have lower estimates of ability relative to the NA students who overestimated in areas the students with LD perceived as deficits. Future studies in this area might provide measures of self-concept, self-esteem, perceptions of students by others, and additional affective measures which could contribute further insight into the factors affecting students with LD.

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Footnotes

1. In addition to these three supplementary analyses, a fourth analysis was performed in which severity groups were formed based upon differences between each of 21 achievement subtests minus the Full Scale IQ. The averages of these standardized difference scores were determined and a median split was performed. The group that was less than or at the median (LM) was most discrepant in a negative direction and the group that was greater than the median (GM) was least discrepant. Similar to the comparison between the NA group and the total group with LD there were significant three-way interactions on both the WRAT-R and WAIS-R ($F(4,258)=3.89$, $p=.004$; $F(16,1032)=2.04$, $p=.009$; respectively). When post hoc t tests were performed the only differences in patterns from the supplementary analysis with the Decoding scale was on the Digit Span subtest on the WAIS-R).

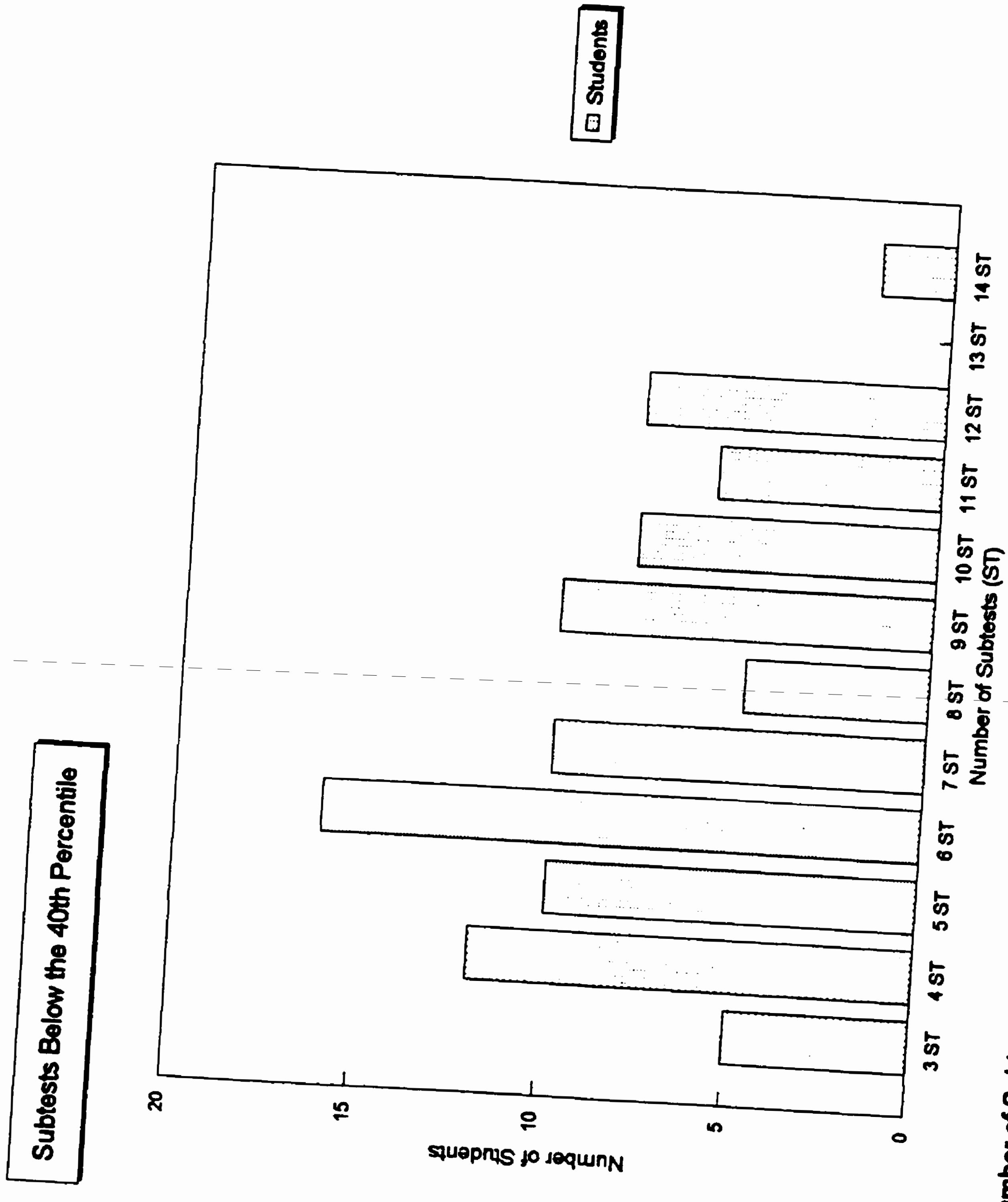
2. Further supplementary analyses were performed for reading comprehension in which a 3 x 2 x 5 ANOVA was computed using the five verbal subtests and a 3 x 2 x 4 ANOVA was computed using the four performance subtests. In this analysis, the verbal tests yielded no significant 3-way interaction ($F(8,516)=1.58$, $p=.128$), but the Group x Predicted/Observed interaction was significant ($F(2,129)=6.56$, $p=.002$). Consistent with hypothesis one, the NA group overestimated but the GMR and LMR groups had veridical estimates. The analysis of the performance tests yielded no significant three-way interaction ($F(6,387)=0.97$, $p=.488$) and consistent with hypothesis 2 there

was no significant two-way Group x Predicted/Observed interaction (***F***(2,129)= 1.83, ***p***=.164). The difference between predicted and observed scores was significant (***F***(1,129)=51.08), ***p***=.001), with the mean of predicted scores (112.28) surpassing the mean of observed scores (104.02).

3. In a repeated measures analysis of variance for the factors Gender by Group by Predicted/Observed Scores by Tests, there was no significant four-way interaction for the WRAT-R (***F***(2,256)=2.13, ***p***=.121), and for the WAIS-R (***F***(8,1024)=0.58, ***p***=.794).

4. A caveat to this study is that the variance of the predicted scores tends to be greater than the variance of the observed scores. This difference in variances tended to be found in most of the comparisons for both the NA group and the group with LD. This condition should be taken into account when interpreting the findings.

Appendix A



Number of Subtests Below the 40th percentile for Students with LD

Appendix B

Table

Means and Standard Deviations for Group with Learning Disabilities

SUBTESTS	N	MEAN	STD.DEV.
WAIS-R VOCABULARY	92	106.14	11.17
WAIS-R ARITHMETIC	92	100.22	11.97
WRAT-R READING	92	105.87	12.49
WRAT-R SPELLING	92	101.98	13.21
WRAT-R ARITHMETIC	92	96.45	14.41
WRAT-R ARITHMETIC PLUS 10 MINUTES	92	107.02	17.65
WOODCOCK-JOHNSON WORD ATTACK	92	105.17	11.44
NELSON DENNY AT 20 MINUTES	92	92.38	12.31
NELSON DENNY WITH EXTRA TIME	92	112.34	9.76
GORT-R COMPREHENSION	92	109.95	15.24
GORT-R PASSAGE	92	107.89	14.81
ARITH EST NUMBERS LATENCY	92	98.95	12.93
ARITH EST MULT ACCURACY	92	99.43	16.09
ARITH EST MULT LATENCY	92	101.55	14.79
PRINT EXPOSURE AUTHORS ACCURACY	92	102.54	13.75
PRINT EXPOSURE AUTHORS LATENCY	92	99.70	14.93
PRINT EXPOSURE MAGAZINES ACCURACY	92	100.91	13.59
PRINT EXPOSURE MAGAZINES LATENCY	92	98.89	16.34
STENCIL SUPERPOSITIONS ACCURACY	81	99.20	16.98
STENCIL SUPERPOSITIONS LATENCY	81	99.74	11.44
PHONOLOGICAL WORD TASK	92	102.76	12.95

Table

Means and Standard Deviations for Decoding Group Scoring Less Than or At the Median (LMD)

SUBTESTS	N	MEAN	STD.DEV.
WAIS-R VOCABULARY	46	102.72	10.42
WAIS-R ARITHMETIC	46	96.96	9.63
WRAT-R READING	46	97.43	10.73
WRAT-R SPELLING	46	92.74	12.35
WRAT-R ARITHMETIC	46	92.37	12.16
WRAT-R ARITHMETIC PLUS 10 MINUTES	46	103.09	17.26
WOODCOCK-JOHNSON WORD ATTACK	46	97.77	8.81
NELSON DENNY AT 20 MINUTES	46	91.14	12.46
NELSON DENNY WITH EXTRA TIME	46	111.87	9.85
GORT-R COMPREHENSION	46	111.32	14.06
GORT-R PASSAGE	46	105.02	15.42
ARITH EST NUMBERS LATENCY	46	100.39	10.62
ARITH EST MULT ACCURACY	46	96.28	17.32
ARITH EST MULT LATENCY	46	100.61	13.55
PRINT EXPOSURE AUTHORS ACCURACY	46	97.72	12.45
PRINT EXPOSURE AUTHORS LATENCY	46	101.43	14.92
PRINT EXPOSURE MAGAZINES ACCURACY	46	97.74	14.09
PRINT EXPOSURE MAGAZINES LATENCY	46	97.91	17.78
STENCIL SUPERPOSITIONS ACCURACY	42	102.70	14.55
STENCIL SUPERPOSITIONS LATENCY	42	96.67	9.79
PHONOLOGICAL WORD TASK	46	96.33	14.26

Table

Means and Standard Deviations for Decoding Group Scoring Greater than the Median (GMD)

SUBTESTS	N	MEAN	STD.DEV.
WAIS-R VOCABULARY	46	109.57	10.95
WAIS-R ARITHMETIC	46	103.48	13.24
WRAT-R READING	46	114.30	7.40
WRAT-R SPELLING	46	111.22	5.08
WRAT-R ARITHMETIC	46	100.52	15.44
WRAT-R ARITHMETIC PLUS 10 MINUTES	46	110.94	17.33
WOODCOCK-JOHNSON WORD ATTACK	46	112.57	8.66
NELSON DENNY AT 20 MINUTES	46	93.63	12.16
NELSON DENNY WITH EXTRA TIME	46	112.81	9.76
GORT-R COMPREHENSION	46	108.59	16.37
GORT-R PASSAGE	46	110.76	13.75
ARITH EST NUMBERS LATENCY	46	97.50	14.87
ARITH EST MULT ACCURACY	46	102.59	14.16
ARITH EST MULT LATENCY	46	102.50	16.03
PRINT EXPOSURE AUTHORS ACCURACY	46	107.37	13.42
PRINT EXPOSURE AUTHORS LATENCY	46	97.96	14.90
PRINT EXPOSURE MAGAZINES ACCURACY	46	104.09	12.43
PRINT EXPOSURE MAGAZINES LATENCY	46	99.87	14.89
STENCIL SUPERPOSITIONS ACCURACY	39	95.43	18.71
STENCIL SUPERPOSITIONS LATENCY	39	103.05	12.27
PHONOLOGICAL WORD TASK	46	109.20	7.27

Table

Means and Standard Deviations for Reading Comprehension Group Less Than or At the Median (LMR)

SUBTESTS	N	MEAN	STD.DEV.
WAIS-R VOCABULARY	46	100.43	9.24
WAIS-R ARITHMETIC	46	97.39	10.63
WRAT-R READING	46	101.41	13.63
WRAT-R SPELLING	46	97.67	14.38
WRAT-R ARITHMETIC	46	92.52	15.18
WRAT-R ARITHMETIC PLUS 10 MINUTES	46	101.06	18.08
WOODCOCK-JOHNSON WORD ATTACK	46	103.38	12.53
NELSON DENNY AT 20 MINUTES	46	85.33	8.18
NELSON DENNY WITH EXTRA TIME	46	107.67	8.78
GORT-R COMPREHENSION	46	99.87	12.52
GORT-R PASSAGE	46	97.32	11.30
ARITH EST NUMBERS LATENCY	46	100.61	14.38
ARITH EST MULT ACCURACY	46	98.39	17.18
ARITH EST MULT LATENCY	46	104.28	16.73
PRINT EXPOSURE AUTHORS ACCURACY	46	99.57	14.36
PRINT EXPOSURE AUTHORS LATENCY	46	102.04	12.96
PRINT EXPOSURE MAGAZINES ACCURACY	46	97.48	13.85
PRINT EXPOSURE MAGAZINES LATENCY	46	98.63	10.91
STENCIL SUPERPOSITIONS ACCURACY	41	98.80	14.99
STENCIL SUPERPOSITIONS LATENCY	41	98.33	10.09
PHONOLOGICAL WORD TASK	46	101.28	13.66

Table

Means and Standard Deviations for Reading Comprehension Group Greater than the Median (GMR)

SUBTESTS	N	MEAN	STD.DEV.
WAIS-R VOCABULARY	46	111.85	10.02
WAIS-R ARITHMETIC	46	103.04	12.67
WRAT-R READING	46	110.33	9.43
WRAT-R SPELLING	46	106.28	10.40
WRAT-R ARITHMETIC	46	100.37	12.58
WRAT-R ARITHMETIC PLUS 10 MINUTES	46	112.97	15.17
WOODCOCK-JOHNSON WORD ATTACK	46	106.96	10.05
NELSON DENNY AT 20 MINUTES	46	99.44	11.73
NELSON DENNY WITH EXTRA TIME	46	117.01	8.43
GORT-R COMPREHENSION	46	120.04	10.22
GORT-R PASSAGE	46	118.46	9.37
ARITH EST NUMBERS LATENCY	46	97.28	11.22
ARITH EST MULT ACCURACY	46	100.48	14.94
ARITH EST MULT LATENCY	46	98.83	12.14
PRINT EXPOSURE AUTHORS ACCURACY	46	105.52	12.58
PRINT EXPOSURE AUTHORS LATENCY	46	97.35	16.48
PRINT EXPOSURE MAGAZINES ACCURACY	46	104.35	12.56
PRINT EXPOSURE MAGAZINES LATENCY	46	99.15	20.51
STENCIL SUPERPOSITIONS ACCURACY	40	99.60	18.98
STENCIL SUPERPOSITIONS LATENCY	40	101.19	12.65
PHONOLOGICAL WORD TASK	46	104.24	12.25

Table

Means and Standard Deviations for Arithmetic Group Less Than Or At the Median (LMA)

SUBTESTS	N	MEAN	STD.DEV.
WAIS-R VOCABULARY	47	105.32	12.83
WAIS-R ARITHMETIC	47	93.94	9.89
WRAT-R READING	47	104.13	13.20
WRAT-R SPELLING	47	99.98	15.34
WRAT-R ARITHMETIC	47	87.38	9.28
WRAT-R ARITHMETIC PLUS 10 MINUTES	47	94.19	12.23
WOODCOCK-JOHNSON WORD ATTACK	47	103.65	11.87
NELSON DENNY AT 20 MINUTES	47	90.36	12.50
NELSON DENNY WITH EXTRA TIME	47	110.52	10.61
GORT-R COMPREHENSION	47	107.00	15.46
GORT-R PASSAGE	47	105.31	14.56
ARITH EST NUMBERS LATENCY	47	102.83	14.83
ARITH EST MULT ACCURACY	47	90.02	15.66
ARITH EST MULT LATENCY	47	105.38	17.78
PRINT EXPOSURE AUTHORS ACCURACY	47	103.40	13.86
PRINT EXPOSURE AUTHORS LATENCY	47	103.45	17.09
PRINT EXPOSURE MAGAZINES ACCURACY	47	101.60	13.70
PRINT EXPOSURE MAGAZINES LATENCY	47	102.47	20.17
STENCIL SUPERPOSITIONS ACCURACY	40	94.60	17.80
STENCIL SUPERPOSITIONS LATENCY	40	100.48	11.50
PHONOLOGICAL WORD TASK	47	102.23	12.89

Table

Means and Standard Deviations for Arithmetic Group Greater Than the Median (GMA)

SUBTESTS	N	MEAN	STD.DEV.
WAIS-R VOCABULARY	45	107.00	9.19
WAIS-R ARITHMETIC	45	106.78	10.40
WRAT-R READING	45	107.69	11.56
WRAT-R SPELLING	45	104.07	10.30
WRAT-R ARITHMETIC	45	105.91	12.66
WRAT-R ARITHMETIC PLUS 10 MINUTES	45	120.41	11.32
WOODCOCK-JOHNSON WORD ATTACK	45	106.76	10.87
NELSON DENNY AT 20 MINUTES	45	94.50	11.87
NELSON DENNY WITH EXTRA TIME	45	114.24	8.50
GORT-R COMPREHENSION	45	113.04	14.53
GORT-R PASSAGE	45	110.59	14.76
ARITH EST NUMBERS LATENCY	45	94.89	9.11
ARITH EST MULT ACCURACY	45	109.27	9.08
ARITH EST MULT LATENCY	45	97.56	9.49
PRINT EXPOSURE AUTHORS ACCURACY	45	101.64	13.75
PRINT EXPOSURE AUTHORS LATENCY	45	95.78	11.18
PRINT EXPOSURE MAGAZINES ACCURACY	45	100.20	13.59
PRINT EXPOSURE MAGAZINES LATENCY	45	95.16	9.94
STENCIL SUPERPOSITIONS ACCURACY	41	103.68	15.03
STENCIL SUPERPOSITONS LATENCY	41	99.02	11.48
PHONOLOGICAL WORD TASK	45	103.31	13.20

Appendix C

July 14, 1995
Version #8

SELF-ESTIMATES OF INTELLECTUAL FUNCTIONING AND ACADEMIC ACHIEVEMENT

Student's name______________________________
Date tested_______________

Instructions for testing

Different people have different perceptions of their own abilities. In a typical psychological or educational test, you would be asked to answer certain questions, or to perform certain tasks, and then the test would be scored by the psychologist.

Today we will try something very different. Instead of **taking the test**, you will simply **look at an easy and difficult example from each test**, and make an estimate of how well you think you would do **if** you were actually taking the test. That's all. In other words, today we will simply record your own perceptions about your own abilities.

In order to help you to make these estimates, we have created the following **accuracy scale**. As you can see, the scale includes 19 levels, where the bottom is marked [1], the top is marked [19], and [10] is exactly in the middle.

In a few minutes I will show you the first test, and ask you how well you think you would do if you were actually being tested on it. Let's say that you will feel that on that particular test you would perform "like an average person of you age"; in that case you should give yourself a [10] on the **accuracy scale**. If you feel that you would do better than people your age, you should checkmark a number between [10] and [19]; on the other hand, if you feel that you would perform at some level below people of your age, you should indicate a number between [10] and [1], and so on.

Is that clear?

Please take a few seconds to look at all 19 levels and what each of them means.

10 seconds

You may remember that some psychological tests are timed, which means that you have to work fast in order to produce as many correct responses as you can in a limited amount of time. I will therefore also ask you to estimate how fast or slow you think you would perform on a particular test compared to the average person of your age, and then to indicate it on a **speed scale** of [1] to [19].

Take a few seconds to examine the **speed scale**.

10 seconds

Do you have any questions?

Are you ready to begin?

ACCURACY SCALE

19 Much better than almost all people of your age

18

17

16

15

14

13

12

11

10 Like an average person of your age

9

8

7

6

5

4

3

2

1 Much worse than almost all people of your age

1 INFORMATION

The first test is called **INFORMATION**. It contains many questions about the world.

I will give you two examples of such questions, an easy one, and a more difficult one. Just listen, but do not tell me the answers.

EASY **Where does the sun set?**

DIFFICULT **Who were the Wright brothers?**

Please indicate on the **accuracy scale** how well you think you would do on this test.

Now, please indicate on the **speed scale** how fast you would be on this test.

2 PICTURE COMPLETION

The second test is called **PICTURE COMPLETION.** It contains many pictures, and in each picture there is a certain small detail missing. Your task would be to find the missing detail.

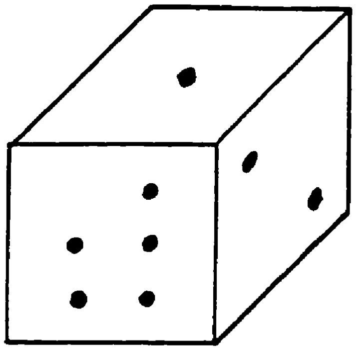
I will show you two examples of such pictures, an easy one, and a more difficult one. Just look, but do not tell me what is missing.

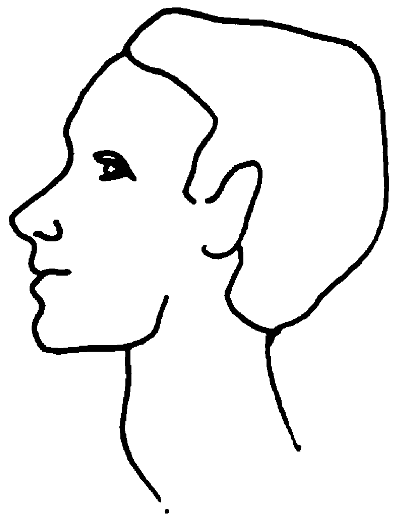
EASY **Dice**

DIFFICULT **Eyebrow**

Please indicate on the **accuracy scale** how well you think you would do on this test.

Now, please indicate on the **speed scale** how fast you would be on this test.





3 DIGIT SPAN

The next test is called **DIGIT SPAN.** This test has two parts. In the first part, I simply say several numbers, and ask you to repeat the numbers in exactly the same order that I said them. Of course, the more numbers there are, the more difficult the task becomes.

I will say two examples of such numbers, an easy (short) one, and a more difficult (longer) one. Just listen, but do not repeat the numbers after me.

EASY **7 5 2**

DIFFICULT **6 9 4 2 7 1 3**

Please indicate on the **accuracy scale** how well you think you would do on this test.

Now, please indicate on the **speed scale** how fast you would be on this test.

In the second part of this task, I also say numbers, but this time you are asked to say them **backwards.** In other words, the number that I say last, you should say first; and the number that I say first, you should say last.

I will say two examples of such numbers, an easy (short) one, and a more difficult (longer) one. Please remember that the task this time would be to say them backwards. Just listen, but do not repeat after me.

EASY **8 3 5**

DIFFICULT **9 4 1 5 7 3 8**

Please indicate on the **accuracy scale** how well you think you would do on this test.

Now, please indicate on the **speed scale** how fast you would be on this test.

4 PICTURE ARRANGEMENT

The next test is called **PICTURE ARRANGEMENT.** You would be presented with a set of several pictures, in a mixed-up order, and you would be asked to arrange them in an order, or a sequence, that tells a sensible story. This test contains many sets of pictures, the easiest set has two pictures, and the most difficult has five pictures.

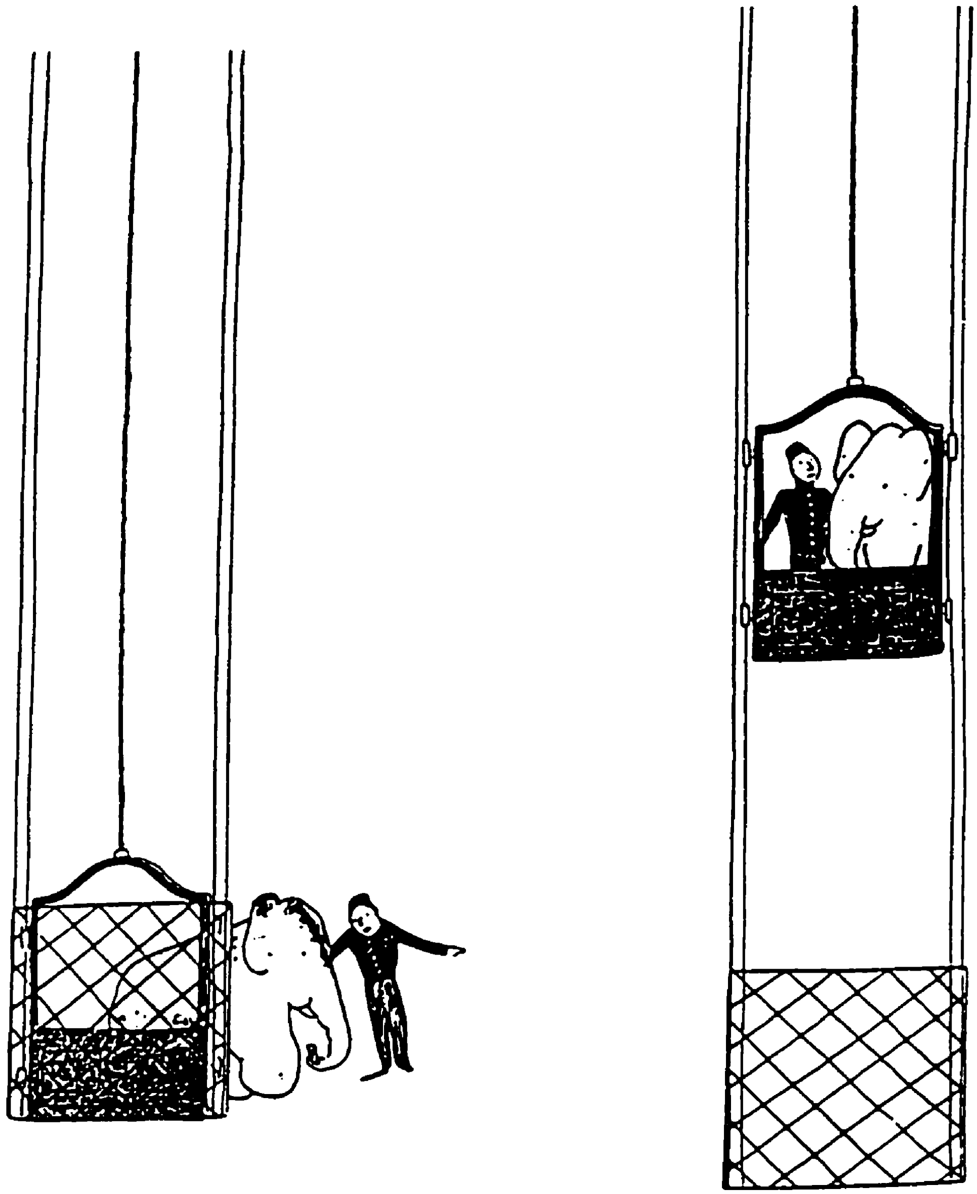
I will show you two examples of such sets of pictures, an easy one, and a more difficult one. Just look at the pictures, but do not try to arrange them.

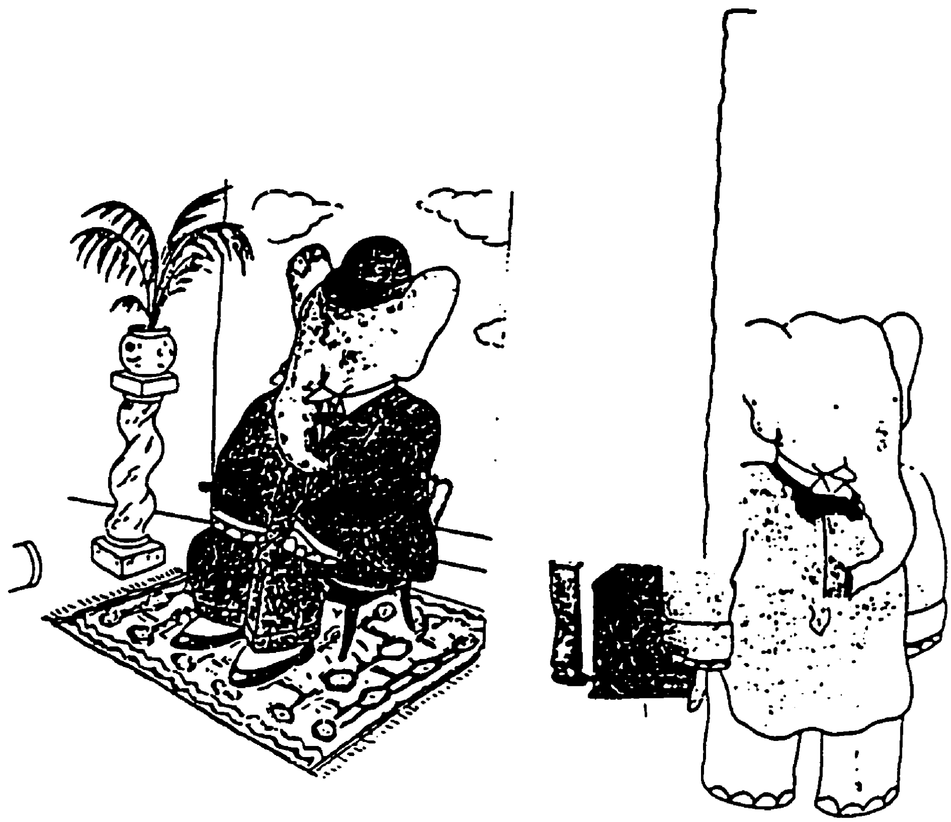
EASY **Elevator**

DIFFICULT **Elephant Dressing**

Please indicate on the **accuracy scale** how well you think you would do on this test.

Now, please indicate on the **speed scale** how fast you would be on this test.





5 VOCABULARY

The next test is called **VOCABULARY.** It contains many questions about the meaning of words.

I will give you two examples of such questions, an easy one, and a more difficult one. Just listen, but do not tell me the answers.

EASY **What does breakfast mean?**

DIFFICULT **What does tirade mean?**

Please indicate on the **accuracy scale** how well you think you would do on this test.

Now, please indicate on the **speed scale** how fast you would be on this test.

6 BLOCK DESIGN

The next test is called **BLOCK DESIGN.** In this test you would be asked to copy a design using coloured blocks. Here are the coloured blocks. These blocks are all alike. On some sides they are all red; on some, all white; and on some, half red and half white.

There are easier designs, where you need only four blocks to copy them, and more difficult designs where you need nine blocks to copy them.

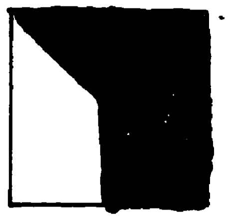
I will show you two examples of such designs, an easy one (with four blocks) and a more difficult one (with nine blocks). Just look, but do not try to copy the designs.

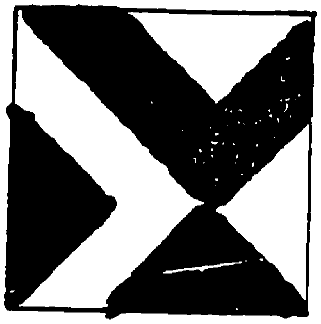
EASY **4 blocks**

DIFFICULT **9 blocks**

Please indicate on the **accuracy scale** how well you think you would do on this test.

Now, please indicate on the **speed scale** how fast you would be on this test.





7 ORAL ARITHMETIC

The next test is called **ORAL ARITHMETIC.** It contains many arithmetic questions. Each question would be read aloud, and then you would be asked to answer verbally, by speaking. You will not be allowed to use pencil and paper.

I will give you two examples of such questions, an easy one, and a more difficult one. Just listen, but do not try to tell me the answers.

EASY **How much is 4 dollars and 5 dollars?**

DIFFICULT **A coat that normally sells for 60 dollars is reduced by 15 percent during a sale. What is the price of the coat during the sale?**

Please indicate on the **accuracy scale** how well you think you would do on this test.

Now, please indicate on the **speed scale** how fast you would be on this test.

8 OBJECT ASSEMBLY

The next test is called **OBJECT ASSEMBLY.** This test contains several sets of parts, each for a different object. You would be presented with a set of parts of an object, and you would be asked to put them together.

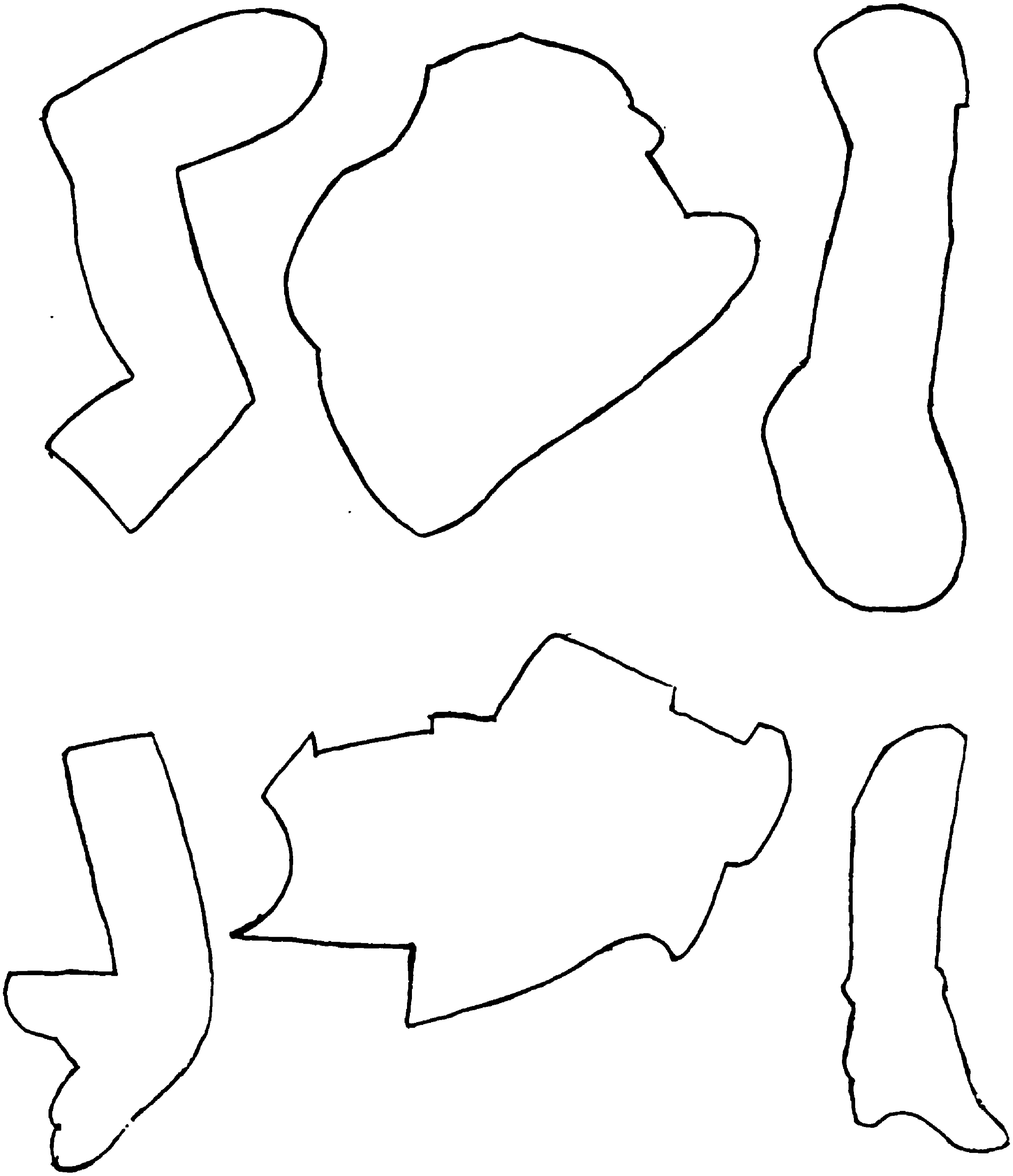
I will show you two examples of such sets of parts, an easy one, and a more difficult one. Just look at the parts, but do not try to put them together.

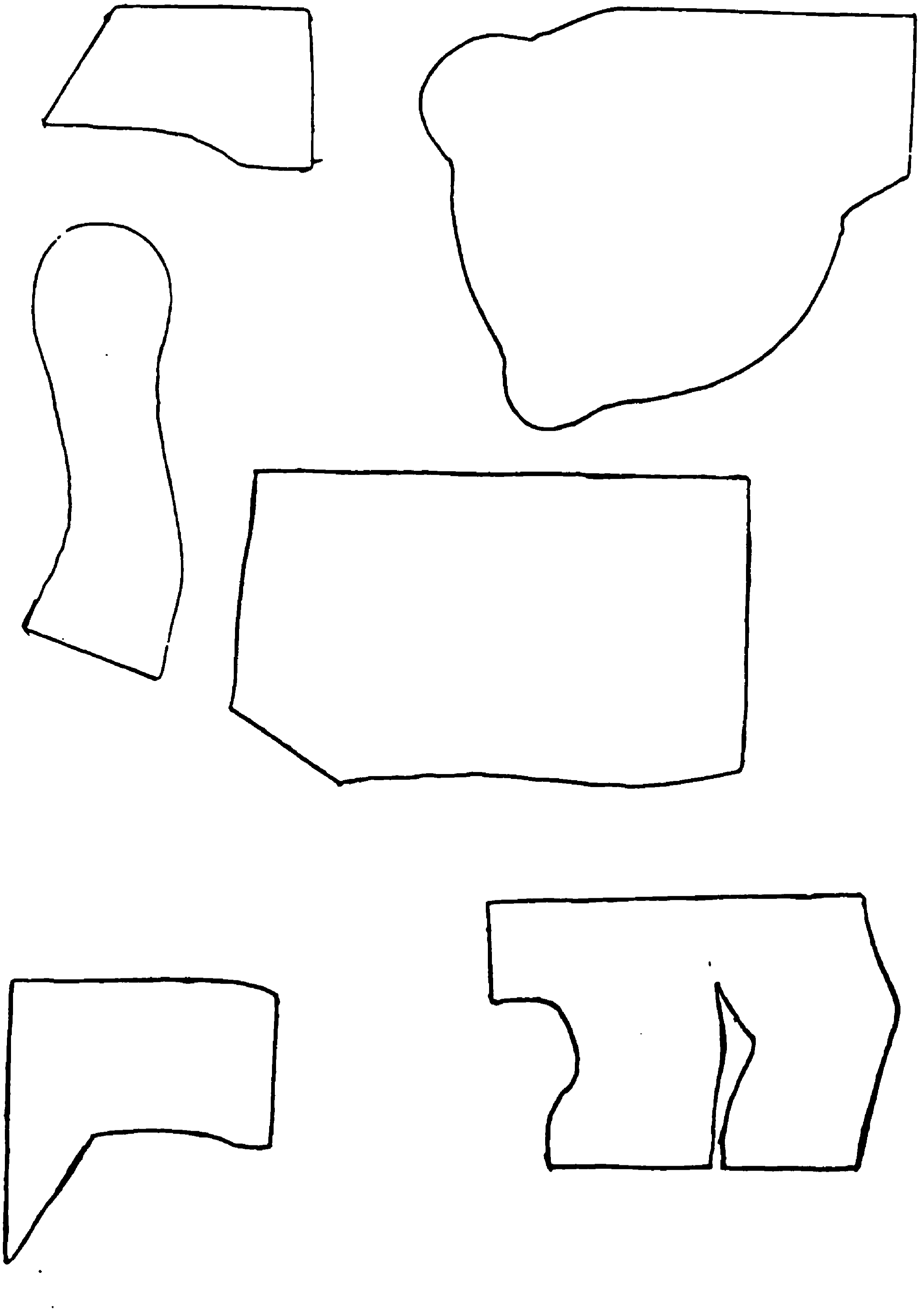
EASY **Pinocchio**

DIFFICULT **Tiger**

Please indicate on the **accuracy scale** how well you think you would do on this test.

Now, please indicate on the **speed scale** how fast you would be on this test.





9 COMPREHENSION

The next test is called **COMPREHENSION.** It contains many questions about the meaning of sentences that would be read aloud to you.

I will give you two examples of such questions, an easy one, and a more difficult one. Just listen, but do not try to tell me the answers.

EASY **What is the thing to do if you find an envelope in the street that is sealed, and addressed, and has a new stamp?**

DIFFICULT **What does this saying mean? 'One swallow doesn't make a summer.'**

Please indicate on the **accuracy scale** how well you think you would do on this test.

Now, please indicate on the **speed scale** how fast you would be on this test.

10 DIGIT SYMBOL

The next test is called **DIGIT SYMBOL.** In this test you would be shown a set of symbols which correspond to the ten digits, 0 through 9, like this. The test is to copy the symbols under the digits.

Here are the digits under which you would have to copy the symbols.

Please indicate on the **accuracy scale** how well you think you would do on this test.

Now, please indicate on the **speed scale** how fast you would be on this test.

The stimuli used for this subtest is the Digit Symbol Subtest from the Wechsler Adult Intelligence Scale-Revised

11 SIMILARITIES

The next test is called **SIMILARITIES.** It contains many questions about the way in which two things are similar.

I will give you two examples of such questions, an easy one, and a more difficult one. Just listen, but do not tell me the answers.

EASY **In what way are an Orange and a Banana alike?**

DIFFICULT **In what way are a Fly and a Tree alike?**

Please indicate on the **accuracy scale** how well you think you would do on this test.

Now, please indicate on the **speed scale** how fast you would be on this test.

12 SPELLING

The next test is called **SPELLING.** In this test words would be read aloud, and you would be asked to write them down with the correct spelling.

I will give you two examples of such words, an easy one, and a more difficult one. Just listen, but do not try to write them down.

EASY **Cat**

DIFFICULT **Iridescence**

Please indicate on the **accuracy scale** how well you think you would do on this test.

Now, please indicate on the **speed scale** how fast you would be on this test.

13 WRITTEN ARITHMETIC

The next test is called **WRITTEN ARITHMETIC.** It contains many arithmetic questions. You would be asked to read each question, and then to answer it in writing.

I will show you two examples of such questions, an easy one, and a more difficult one. Just look, but do not tell me the answers.

EASY $6 - 3 = ?$

DIFFICULT **Find the roots of the equation:**

$$3X^2 - 36X = 162$$

Please indicate on the **accuracy scale** how well you think you would do on this test.

Now, please indicate on the **speed scale** how fast you would be on this test.

Example 1: $6 - 3 = ?$

Example 2: Find the roots of the equation:

$$3X^2 - 36X = 162$$

14 READING

The next test is called **READING.** In this test you would be asked to read aloud single words.

I will show you two examples of such words, an easy one, and a more difficult one. Just look, but do not try to read them aloud.

EASY **Milk**

DIFFICULT **Regicidal**

Please indicate on the **accuracy scale** how well you think you would do on this test.

Now, please indicate on the **speed scale** how fast you would be on this test.

Example 1:	Milk
Example 2:	Regicidal

Appendix D

Examples Used for Self-Estimates and Comparable Questions on the Wechsler Adult Intelligence Scale-Revised

Information

Easy

S: When does the sun set?

W: Where does the sun rise? (Starting Question 5 of 29)

More Difficult

S: Who were the Wright Brothers?

W: Who was Amelia Earhart? (Question 14 of 29)

Picture Completion

Easy

S: Picture of a Die (6th Dot Missing)

W: Picture of Playing Card (9th Diamond Missing)
Question 4 of 20

More Difficult

S: Man's Profile (Eyebrow Missing)

W: Woman's Profile (Eyebrow Missing)
Question 19 of 20

Digit Span Forwards

Easy

S: 7-5-2 (3 digits)

W: 5-8-2 and 6-9-4 (Question 1: 3 digits)

More Difficult

S: 6-9-4-2-7-1-3 (7 digits)

W: 5-9-1-7-4-2-8 and 4-1-7-9-3-8-6 (Question 5: 7 digits)

Digit Span Backwards

Easy

S: 8-3-5 (3 digits)

W: 6-2-9 and 4-1-5 (Question 2; in DSB, Question 1 has 2 digits)

More Difficult

S: 9-4-1-5-7-3-8 (7 digits)

W: 8-1-2-9-3-6-5 and 4-7-3-9-1-2-8 (Question 6; 7 digits)

Picture Arrangement

Easy

S: Elephant and Elevator (2 pieces to story)

W: House (Question 1; 3 pieces)

More Difficult

S: Elephant Dressing (5 pieces)

W: "Flirt" (Question 2: 5 pieces)

Vocabulary

Easy

S: What does breakfast mean?

W: Same as above. (Question 5)

More Difficult

S: What does tirade mean?

W: Same as above. (Question 35: last test question on form)

Block Design

Easy

S:  (4 blocks)

W:  (Question 1; 4 blocks)

More Difficult

S:  (9 blocks)

W:  (Question 8 of 9; 9 blocks)

Oral Arithmetic

Easy

S: How much is 4 dollars and 5 dollars?

W: How much is 4 dollars plus 5 dollars? (Start Question 3)

More Difficult

S: A coat that normally sells for 60 dollars is reduced by 15 percent during a sale. What is the price of the coat during the sale?

W: Same as above. (Question 13 of 15)

Object Assembly

Easy

S: Pinnochio (6 pieces, 5 joints)

W: Manniken (6 pieces, 5 joints)

More Difficult

S: Tiger (6 pieces, 6 joints)

W: Elephant (7 pieces, 8 joints)

Comprehension

Easy

S: What is the thing to do if you find an envelope in the street

that is sealed, and addressed, and has a new stamp?

W: Same as above. (Question 2 of 16)

More Difficult

S: What does the saying mean, "One swallow doesn't make a summer?"

W: Same as above. (Question 15 of 16)

Digit Symbol

S: Subject shown table and test, and explanation provided based upon standardized instructions

W: Subject performs test

Similarities

Easy

S: In what ways are an Orange and a Banana alike?

W: Same as above. (Starting Question 1 of 14)

More Difficult

S: In what ways are a Fly and a Tree alike?

W: Same as above. (Question 13 of 14)

Examples Used for Self-Estimates and Comparable Questions on the Wide Range Achievement Test-Revised

Spelling

Easy

S: Cat

W: Same as above. (Question 1 of 46)

More Difficult

S: Iridescence

W: Same as above. (Question 46)

Written Arithmetic

Easy

S: $6 - 3 = ?$

W: $8 - 4 =$ __ (Question 2)

More Difficult

S: Find the roots of the equation:

$3X^2 - 36X = 162$

W: Find root:

$2x^2 - 36x = 162$ (Last Question of Arithmetic section)

Reading

Easy

S: Milk (1 syllable)

W: Same as above. (Question 1 of 74)

More Difficult

S: Regicidal (4 syllables)

W: Regicidal (Question 65 of 74)

Appendix E

General Difficulty Values of Individual Items of WAIS subtests (Matarazzo, 1972)

Digit Span Difficulty Values by Jastak, 1949)

	Easy	More Difficult
		Percentage Passing
Information	91.0	61.0
Picture Completion	76.0	22.0
Digit Span Forwards	100.0	26.4
Backwards	91.7	3.4
Picture Arrangement	100.0	62.0
Vocabulary	99.0	17.0
Block Design	99.0	35.0
Oral Arithmetic	100.0	28.0
Object Assembly	97.0	67.0
Comprehension	98.0	22.0
Similarities	93.0	18.0

Appendix F

Phonological Word Task*

saip	saif	2
seaf	seet	2
deace	peece	2
docter	doftor	1
blug	bloe	2
carn	kard	2
rall	roal	2
klass	cliss	1
ploor	floar	2
fite	fipe	1
joak	jope	1
filst	ferst	2
caim	pame	1
shurt	shart	1
neach	teech	2
strate	strale	1
nade	naim	2
thord	thurd	2
hoap	hote	1
reech	reash	1
thrue	threp	1
floap	flote	2
bair	beal	1
tracter	trastor	1
feem	fead	2
gaim	gome	1

* Number represents which pseudoword sounds most like a real word in each of the 26 trials

(Test developed by Shafrir, 1994)

Appendix G

$25.00 for 2 1/2 Hours

ADULTS REQUIRED FOR STUDENT ASSESSMENT PROJECT

-ENGLISH FIRST LANGUAGE
-NO LEARNING DISABILITY

PLEASE CALL
J. Slemon, Adult Study Skills Clinic
Ontario Institute for the Study of Education
(416) 923-6641 ext 2373
9:00 am to 4:00 pm, Monday to Thursday

Appendix H

Letter of Intent

I am a graduate student in the Department of Applied Psychology at the Ontario Institute for Studies in Education. The Ethical Review Board at the University of Toronto has given me permission to conduct a study with adults that compares their estimates of their ability with actual performance. My work will be supervised by Dr. Uri Shafrir. The purpose of my study is to investigate differences between believed and actual scores of adults to determine how these beliefs affect performance.

We would like your permission to participate in this study. If you agree, a brief questionnaire regarding your educational history will be administered. You will then be asked to estimate your ability in specific cognitive tasks, and next, write a test of academic achievement and one of intellectual ability.

Your participation in this study is entirely voluntary, and you may withdraw from the study at any time. The material collected will not affect your educational program in any way. All data obtained from you will be confidential. Written reports of the study will not refer specifically to people nor institutions.

Please indicate whether you would like to participate in the study by signing the form attached. If you have any questions about the study, please write or call.

Sincerely yours,

Jill Slemon

Appendix I

Research Consent Form

I have read the letter explaining the research study to be conducted by Jill Slemon. I understand that I will be asked to fill out a questionnaire about my personal learning history, predict my performance on several ability areas, and write a test of academic achievement and one of intellectual ability. I also understand that my participation is voluntary, that I may withdraw from the study at any time, and that I will be paid twenty-five dollars for participating in this study for approximately two and a half hours.

____

Signature

____

Date

Appendix J

Table

Orthogonal Rotation of Principal Components, Variables Used in Study with Additional Seven Subtests from the WAIS-R

Subtests	*Factor Loading on Rotated Factor Patterns					
	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6
WRARITH	0.74467*	0.06083	0.17076	0.12131	-0.26222	0.13718
WRARITH10	0.78912*	0.12451	0.13661	0.19693	-0.22840	0.10018
ORAL ARITH	0.49452*	0.24081	0.14871	-0.00126	-0.35665	0.35983
AEMULTAC	0.71600*	0.13154	0.05930	-0.07602	0.15820	0.00807
AENUMLAT	-0.53554*	-0.02222	0.27915	-0.03611	0.39964	-0.01692
PICTCOMP	-0.11257	0.55648*	0.02827	0.15374	0.02826	-0.09973
BLOCKDES	0.37256	0.78047*	-0.18484	0.08049	-0.03856	-0.08406
OBJASSEMB	0.16228	0.74543*	-0.23623	0.03577	-0.02140	-0.04355
SPELLING	0.29691	-0.52201*	0.20557	0.19688	0.01621	0.56347*
STENCAC	0.33547	0.59487*	-0.23940	0.13457	0.10620	-0.15490
INFORM	0.36953	0.02382	0.64115*	0.35321	0.00951	-0.06807
VOCABULARY	0.24915	-0.06832	0.66673*	0.32770	0.16711	0.21423
DIGITSYMB	0.12290	0.27754	-0.52574*	0.17673	-0.35822	-0.04906
PXAUTAC	-0.14536	-0.35768	0.65159*	0.14849	-0.05593	0.12576
PXMAGAC	-0.01855	-0.08957	0.76902*	0.07554	-0.06075	0.03326
SIMILAR	0.25695	0.41338	0.44986*	0.02109	0.12880	0.19643
NELDEN20	0.04063	-0.01714	0.24873	0.72198*	-0.30336	-0.01329
NELDENOWN	0.30093	0.01201	0.20338	0.58774*	0.17188	-0.06551
GORT-RCOM	0.02870	0.23351	-0.00594	0.81716*	-0.13631	0.07443
GORT-RPAS	-0.01666	-0.02332	0.07562	0.78643*	-0.15728	0.32386
AEMULTLAT	0.13079	0.04477	0.02662	-0.23252	0.71943*	-0.13360
DIGITSPAN	0.43480	-0.33038	-0.19436	0.15042	0.21081	0.15524
PXAUTLAT	-0.28920	0.06470	0.00109	-0.09857	0.62639*	0.11717
PXMAGLAT	-0.13117	-0.06428	0.11057	-0.04374	0.81066*	0.12375
STENCLAT	0.12058	-0.64260	-0.09583	0.19538	0.47421*	0.00784
READING	0.12928	-0.38138	0.30186	0.23483	-0.12974	0.64596*
WRDATTACK	0.07614	-0.03298	0.19309	-0.02809	-0.01260	0.80824*
PHOWRD	0.02719	-0.08106	-0.15285	0.10481	0.19687	0.75166*

Note. Loadings with asterisks are greater than .45.

LEGEND:

INFORM -INFORMATION
DIGIT SPAN
VOCABULARY
SIMILAR - SIMILARITIES
PICTCOMP - PICTURE COMPLETION
BLOCKDES - BLOCK DESIGN
OBJASSEMB - OBJECT ASSEMBLY
DIGSYMB - DIGIT SYMBOL
READING - WRAT-R
SPELLING - WRAT-R
WRDATTACK - WORD ATTACK
PHOWRD -PHONOLOGICAL WORD TASK

PXAUTAC -PRINTEXP.AUTHOR ACCURACY
PXAUTLAT -PRINTEXP.AUTHOR LATENCY
PXMAGAC -PRINTEXP.MAGAZINE ACCURACY
PXMAGLAT -PRINTEXP.MAGAZINE LATENCY
ORAL ARITH - WAIS-R ARITHMETIC
WRARITH - WRAT-R WRITTEN ARITHMETIC
WRARITH10 - WRAT-R ARITHMETIC (10 EXTRA MIN.)
AEMULTAC -ARITH.ESTIMA.MULTIPLICATION ACCUR
AENUMLAT -ARITH.ESTIMA.NUMBER MATCHING LAT
AEMULTLAT -ARITH.ESTIMA.MULTIPLICATION ACCUR
STENCAC -STENCIL SUPERPOSITIONS-ACCURACY
STENCLAT -STENCIL SUPERPOSITIONS-LATENCY

Appendix K

Table

Correlations among Decoding, Reading Comprehension, and Arithmetic Factor Scores

	Decode	Rd Comp	Arithmetic
Decode	1.0000		
Rd Comp	0.1739	1.0000	
Arith	0.1087	0.1957	1.0000

Note. Decode = Decoding Factor, Rd Comp = Reading Comprehension Factor, Arith = Arithmetic Factor.

Contingency Table

Number of Students with LD Lower or At the Median (LM) or Greater than the Median (GM) on Decoding, Reading Comprehension, and Arithmetic Factors

Arith	Rd Comp	Decode LM	Decode GM	TOTAL
LM	LM	16	12	28
	GM	10	9	19
	TOTAL	26	21	47
GM	LM	11	7	18
	GM	9	18	27
	TOTAL	20	25	45

TOTAL OF THE OBSERVED FREQUENCY TABLE IS 92

Note. Decode = Decoding Factor, Rd Comp = Reading Comprehension Factor, Arith = Arithmetic Factor.

VITA

NAME:	Jill Coral Slemon
PLACE OF BIRTH:	Toronto, Ontario, Canada
POST-SECONDARY EDUCATION AND DEGREES:	The University of Western Ontario London, Ontario **Bachelor of Arts**, 1982-1985 (English) **Master of Education**, 1989-1991 (Counselling) **Bachelor of Education**, 1991-1992 (Visual Arts) O.I.S.E., University of Toronto Toronto, Ontario **Doctor of Education**, 1993-1996 (Applied Developmental Psychology)
AWARDS:	**Dorothy Emery Memorial Award in Visual Arts Education**, 1992 Slemon, J.C. (1990). Verbal and nonverbal components in art education. Journal of the Ontario Society for Education Through Art, 21, 78-82. **Dean's Honour List** 1984-1985 1988-1989
RELATED WORK EXPERIENCE:	**Assessment**, 1994-1996 O.I.S.E., University of Toronto **Remediation**, 1995-1996 O.I.S.E., University of Toronto **Counsellor**, 1992-1993 Sir Sandford Fleming College, Academic Upgrading and Apprenticeship & Technology Departments Peterborough, Ontario

VITA (CONTINUED)

Counselling Internship, 1990-1991
Lester B. Pearson Public School
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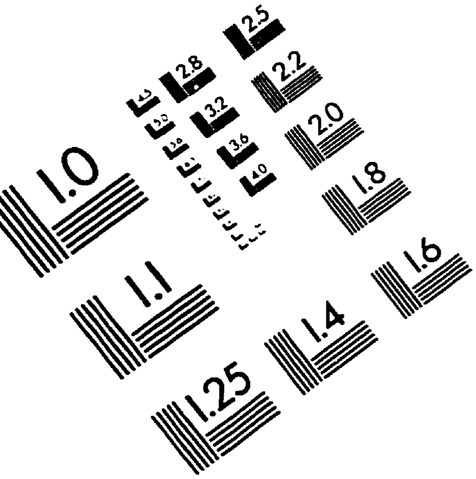
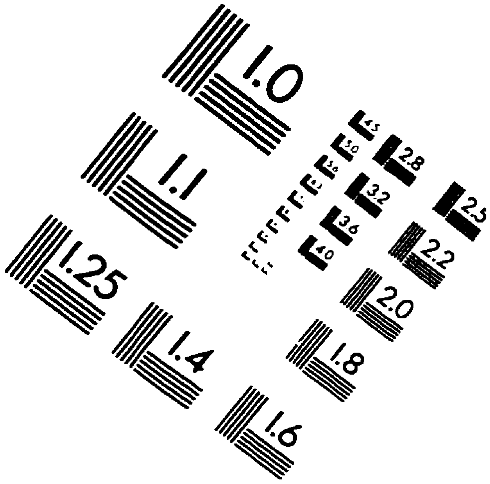
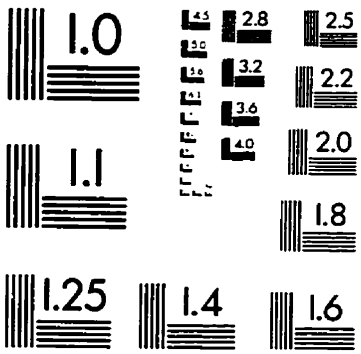
Research Assistant, 1990-1991
Faculty of Education, The
University of Western Ontario
London, Ontario

Research Assistant, 1989-1990
Faculty of Education, The
University of Western Ontario
London, Ontario

IMAGE EVALUATION TEST TARGET (QA-3)







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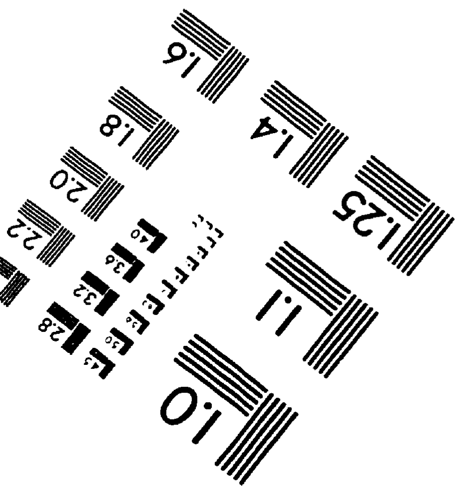

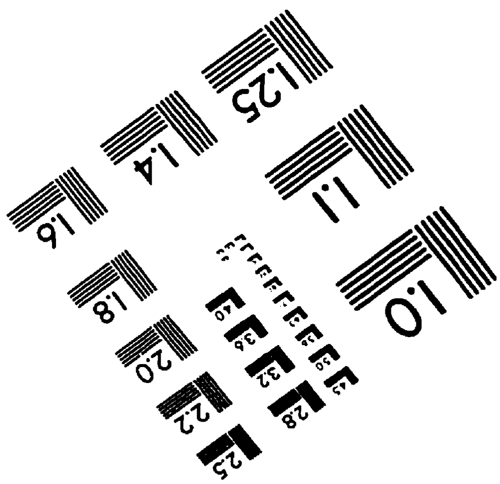

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